

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

DEC. 8, 1952

50 CENTS



THEN
and **NOW**



Iceguard, Airfoam—T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Dependability Comes First!

SINCE the Navy began flying wheeled aircraft in 1911 with the Wright Brothers B-1, they've always been sticklers for dependability — just as they are today with the "Skyshark," first Turbo-Prop shipboard fighter to join the fleet. And ever since Goodyear built the first Wing Airplane tire for the early Wright ships, dependability has been the watchword here, too.

The Douglas A2D "Skyshark" is the latest in a long line of Navy planes 100%-equipped with Goodyear Tires, Tubes, Wheels and Brakes — selected again for their proved ability to withstand the strains of carrier deck landings and take-offs.

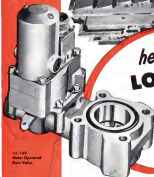
Wherever greater safety and dependability are concerned, Goodyear equipment gets first call — in



military and naval service as well as on commercial and private craft. For further details on any Goodyear product for aviation—tires, tubes, wheels, brakes, bullet-sealing tanks, Iceguard equipment and Airfoam Super.

Goodyear, A
Akron 16, Ohio

West Union and Peabody
General Company, Mine
Office and Factory with
140 000 sq. ft. under roof.
Large facility for quality
production in volume to
customers.



Appl. Ergon.



New Catalog 3.3d ...
years for the asking
on your company
Internet, please



here's why
LOCKHEED
said

OK

New and revolutionary in design, Model AV-16 Gate Valves provide the aircraft industry with a dependable and trouble-free shut-off valve for high flow capacity systems—fuel, oil, water, slush and coolants. Model AV-16 is shown at left in a 34 volt electric motor drive control incorporating planetary reduction gearing, positive drive clutch of the controlled type, with manual release switches. Meets all standard valve

cations and proposed Army-Navy requirements. At Lockheed, the AV-1B is designed as the F3V ship for control of fuel to engines, transfer of fuel from tank to tank as well as for refueling. Combining, as it does, the qualities of efficiency and dependability with the new production facilities to be found at General Cowi's, the AV-1B from the stamp of Lockheed appeared as it does of the industry at large.

GENERAL CONTROLS

www.elsevier.com/locate/jmb

GLENNAL L. CAULF

Manufacturers of Automobile Pumps, Transformers, Lined and Flow Controls

Copyright © 2004 John Wiley & Sons, Ltd.




Now Reporters will
 be able to report on
 illegal Internet activity
 in the privacy of their
 homes.

Ball Bearings Are Basic In Sensitive Instrumentation

Moving parts of sensitive instruments call for the extremely accurate, low friction support that only ball bearings can provide. And, whether it's a low torque or high speed application, New Departure meet the most stringent specifications.

Ball bearing production at New Departure is the epitome of precision. Balls for many instrument bearings are ground to within 10-microns of an inch variation in diameter, and sphericity within five millionths! Instrument bearings are assembled, supported and packed under surgical standards of cleanliness.

Through its resources of research . . . its engineering excellence . . . its precision production . . . New Departure is the recognized leader in the industry. Keep your eye on the ball, to be sure of your position!

NOTHING WOULD LIKE A BALL 

NEW DEPARTURE

HOW SUPPLIERS : DIVISION OF CONCRETE; HOW TO : BEGETH, CONCRETE

How Tight is LEAKPROOF?



CIRCLE-SEAL provides
dead tight sealing in
pressures as low as
3" H₂O — as high as
pneumatic pressure.

Dead tight means NO
leakage NO dripping.



200 SERIES combines low crushing pressure, high strength. Will stand to back high pressure pneumatic systems and low pressure pneumatic and vacuum service.

300 SERIES provides physical and functional characteristics comparable to existing check valves—insures zero leakage even with full or full vapor or over the nominal or any condition.

	200 Series	300 Series
Pressure	0 to 2000 psi	0 to 400 psi
Temp range	-65° F to 300° F	-65° F to 300° F
Grading Pressure	no restriction	0" to 10" H ₂ O
Size	1/2" to 1 1/2" Tube	1/2" to 1 1/2" Tube
Sealability	no leakage with closed valves, except on large size	no leakage with closed valves, except on large size

CIRCLE SEAL
proven check valves

JAMES DOND CLARK

2121 E. 1st St., Portland, Ore. 97232 • Call
527-1111. For details send free of charge on request

Aviation Week

Volume 57

December 4, 1952

Number 23

Headline News

LAUN's Cost Against Crash Landing 12
Petersen, Harns, Crash Technology 13
CAA Rebuffes Development Setup 15
Prop. Work Center Plans Crashed 16
New Condens. Aircraft Carburizer 18
Weight Upset For Army Planes 17
Foster Engine Delivers 12
Short Close Next For Jet Orders 18
World Aircraft 18
New & Aboard Service Sample 18

Production Engineering

RYKO's Copiers Roll Out for Navy 20
Edlin Jet Plane Starts on Assembly 21
Pump Pumps by Collins Research 22
Search Is Word for EMI Tools 23

Departments

New Design 7
Aviation Calendar 8
Feature Page 9
Off the Line 10
Who's Where 11
Industry Observer 11
Wonders of Science 12
Production Briefing 13
USAF Contracts 14

Avionics

ANDB Is Test Your Man's CEA? 59

Equipment

Separator Spins Water Out 61
Short Complete New Test Plan 58

Air Transport

New Capital Counting Seen 61
Inland Jet Airline Growth 62
Airframe Needs and Problems 63
Airframe Building Needs Cloud 64
Prop. Revised on 100000000 65

Editorial

The Complex Problem IV 66

42,212 copies of this issue printed

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Alexander McHenry

David A. Anderson

Irving Stone

G. L. Christian III

Katherine Johnson

Lee Moore

Peter K. Kline

Aviation Week

Aviation Week

Aviation Week

Aviation Week

Aviation Week

Aviation Week

Aviation Week

Robert E. Hale

Robert E. Hale

Robert E. Hale

Robert E. Hale

Robert E. Hale

Robert E. Hale

Robert E. Hale

New Editor

New Editor

New Editor

New Editor

New Editor

New Editor

New Editor

R. W. Martin, Jr., General Manager, J. C. Johnson, Business Manager, California
Miss. Research and Marketing; Sales Representatives: J. C. Anderson, P. W. Smith,
R. P. Johnson, Cleveland, L. J. Day, Chicago, W. E. Dornick, St. Louis, E. F. Brown,
B. W. Brown, James Cook, Dallas, R. C. Stauder, Atlanta, E. F. Dornick, Jr.,
San Francisco, C. F. Malley, Los Angeles, W. S. Brown, Philadelphia (other
sales office in Philadelphia District, London)

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Editor: H. Wood

Look what's new in AIR VALVES



A few of the 225
types—no two alike
—tailored for aircraft
by AiResearch

Shows here is a handful among
the latest advances in air valves
designed by AiResearch.

When such as these are used
only control air and gas flow
on today's jet and turbo-prop air-
craft. AiResearch designs them
every conceivable application.
Now in production are valves
made of stainless steel which
handle temperatures up to
3000° F., valves of aluminum
which open and close fully with
in 0.00001 seconds—valves with
less than .001 pounds per
square inch at 100 PSI.

Typical new applications are
shown below for mixing, con-
trolling gas and liquid flow, in
advance design present into
service, rate for reducing gas
velocity components.

AiResearch which designs and
manufactures thousands of air-
craft accessories in many fields
also makes manual, electrical,
or pneumatic systems for the
reliable operation of air valves.

Would you like to work with Ai?
Qualified engineers, scientists and
skilled craftsmen are needed for
all divisions.

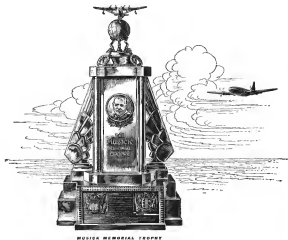


AiResearch Manufacturing Company

A DIVISION OF THE GARRETT CORPORATION

101 ANGELES AVE., CALIFORNIA • PHOENIX, ARIZONA

AREZARCO air valves in the design and manufacture of aircraft accessories in the following areas: solenoid, air turbine, refrigeration, valve, supercharger, gas turbine, pneumatic pressure valve, electronic control, heat transfer equipment, electric structure, valve pressure control and air valves.



MAICK MEMORIAL TROPHY

"...most effective in furthering the safety of aircraft..."

The Maick Memorial Trophy honors throughout the world of aviation is for annual reward in the group, both in industry which has recently made the contribution, development or improvement which by its practical application has become most effective in furthering the safety of aircraft with special reference to atmospheric aviation or directly or indirectly the efficiency of aircraft.

The trophy was established in 1938 by citizens of Auckland, New Zealand, in memory of Capt. Edwin C. Maick, and his six companions in the "Juncosan Clipper" who were lost in the South Pacific on January 12, 1935, while making the first commercial flight from the United States to New Zealand.

For its contribution in furthering the safety of transoceanic aircraft, the Sperry Engine Analyzer has recently won the Maick Memorial Trophy for 1951. This award was made to John E. Lindberg, Jr. and James W. Wheeler who jointly developed the Analyzer. At the time of this development, Lindberg was a staff engineer in the Pacific-Alaska Division of Pan American World Airways and Wheeler was head of the engine maintenance department

of the Sperry Gyroscope Company.

Ascribed for its contribution to flight safety, the Analyzer is in wide use on commercial and military planes throughout the world. It immediately detects, locates and identifies detailed ignition and mechanical troubles in aircraft power plants either during flight or on the ground.

Sperry Gyroscope Company
(Division of The Sperry Corporation)
Great Neck, New York

Domestic

MacDonald-Douglas says that its new E-11 electronic pilot, slated for use on the new two-qt Douglas B-66, is also designed for use on interceptors when it can automatically guide the plane to the target, setting firm signals provided by the plane's radar and computer. M-11 says it has orders for E-11s for use on the B-66 (as reported in AVIATION WEEK Sept. 19) but mentions no possible fighter or intercepter applications. The E-11 is now under consideration for use on the new McDonnell P-501.

Joseph Adams, Civil Aeronautics Board member, has been appointed by the President to succeed former CAB Chairman Donald Nixon on the National Advisory Committee for Aeronautics (NACA).

Flight Refueling, Inc., Danbury, Conn., will event under the control of an American group which includes Republic Motors, Inc., Redwings, N. J.; Laurence S. Ruckelshaus, New York, and associates, according to an agreement transferring controlling interest from Flight Refueling Ltd., Dorset, England. The agreement is subject to stockholders' approval and other conditions.

William P. Evans has been appointed manager of the Air Transport division of the Flight Safety Foundation.

Aircraft Industries Ann of America reports 272 patents and 2,000 research reports were shipped during the month of October, packing 210 four-page or larger and 42 one- and two-page pieces. Value was given as \$2,634,000.

St. Geoffrey de Harland was presented with the David Cleggman medal "for 40 years of pioneering an industry and commercial growth and the development of long range jet transport" at the annual banquet of American Society of Mechanical Engineers at the Statler Hotel, New York, last week.

William E. Hoffmann, vice president engineering, American Airlines, will give the introductory Wright Brothers lecture Dec. 17 in Washington, honoring "Technical Trends in Air Transportation."

Eastern Air Lines Constellation flight engineers last week went on strike, crippling much of the carrier's operations.



ATTENDING SAFETY MEET sponsored by Flight Safety Foundation in Honolulu recently were (left to right) Arthur Jinks, CAA, Herbert Fisher, Post of N. Y. Air

troops. Without resulted from a jet engine and disengagement of a new contract with EAL. Coaches were provided as flight engineers are not used on other corporate planes.

Selig Shohet, independent aviation consultant and contributing financial editor of AVIATION WEEK, delivered the aviation lecture at the New York Institute of Finance for the fourth consecutive year. He discussed aviation Nov. 10 and the aircraft group Dec. 4. The institute is affiliated with the New York Stock Exchange.

Financial

Northwest Airlines reports net income after taxes of \$749,945 for the month of October. Net income for the first 10 months of 1952 was \$1,512,999 from total revenues of \$46,313,193.

Northrop Aircraft has declared a regular quarterly dividend of 15 cents a share payable Dec. 17 to stockholders of record Dec. 3. Net income after taxes for the three-month period ending Oct. 31 was \$1,593,995, including income from Northrop Corp., a wholly owned subsidiary. Earnings as of Oct. 31 was \$102 million.

Solar Aircraft Co. reported net income for the month of October ending Oct. 31 of \$1,239,700. Unfilled orders exceeded \$92 million.

Standard Machine Tool Co. has declared a 5% stock dividend in addition to a regular quarterly dividend of 30 cents a share, both payable on Dec. 20 to stockholders of record Dec. 10.

Shore Ship Net Corp. of America has declared a dividend of 30 cents a share payable Jan. 5 to stockholders of record Dec. 15, and an additional dividend of 25 cents payable Feb. 2 to stockholders of record Jan. 15.

International

Hawker Siddeley Group, Ltd., will soon have in production an improved version of the Double Mustang turbo-prop engine. The new and four unit, known as ASH101, has a takeoff rating of 3,125 hp. and consists of two side-by-side engines. Designed for use on the Fawcett Hawk, HS says it will run on diesel oil, kerosene, "waste oil" or kerosene fuel, or any mixture of the three, with a fuel consumption of 274 gph/hr.

British Overseas Airways has under consideration a civil version of the new two-engine 4000 Vickers.

British European Airways soon will take delivery on the first of 26 De Havilland six-engine turboprop aircraft, recently ordered by the Air Registration Board. A second production De Havilland is about ready for flight tests.

First A. V. Roe-Bellanca Constellation made its first flight Nov. 25, 1949, and two weeks after the first commercial production.

The Canadian Department of the Interior Production Relief Aircraft Program, plans and overhaul factory \$2,157,500 during the first half of November. Largest order (\$523,500) went to Canadair, Ltd., Montreal, for major maintenance stands.

Consistent QUALITY...

Put **A.R.C.** On the Map



On air map or road map of New Jersey, you will see the name "Aircraft Radio" marking our location just N.W. of Doonane.

Names don't appear on the map overnight. It takes stability and reputation. And as we approach our 25th anniversary, it is gratifying to know that A.R.C. has been "put on the map" in another sense, too. All over the world, A.R.C. is known and our communications and navigation instruments are widely used and trusted.

A.R.C. has become a standard of excellence on its field because it is quality-built for precision rather than price. Into each unit go the finest of new parts—plus 24 years of specialized engineering experience.

**VHF NAVIGATIONAL RECEIVERS
MARKER BEACON RECEIVERS
ISOLATION AMPLIFIERS
OF RANGE RECEIVER WITH LOOP
FOR TEST EQUIPMENT
MICROWAVE TEST EQUIPMENT**



Dependable
Electronic Equipment
Since 1928

Aircraft Radio Corporation
BOUNTON NEW JERSEY

AVIATION CALENDAR

- Dec. 12—Second Convertible Aircraft Congress. The Franklin Institute, Philadelphia.
- Dec. 17—National Wright Bros. dinner, 7:30 p.m., Statler Hotel, Washington, D. C. Wright Bros. lecture to be presented by LSC 1 p.m., U. S. Chamber of Commerce, audience.
- Jan. 12—Boeing meeting and registration display at Society of Automotive Engineers, Executive Building, Detroit.
- Jan. 14-16—AIREX 1958 Conference on High Frequency Communications, Statler Hotel, Washington, D. C.
- Jan. 17-18—Sixth Ocean Customs Study Operators Training School, University of Illinois, Urbana, Ill.
- Jan. 18-19—Plant Maintenance Conference, Fisher Industries, Cleveland, O.
- Jan. 19-23—Winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York, N. Y.
- Feb. 14—New York Section of the Institute of Management Science, Hotel Statler, New York, N. Y.
- Feb. 15-19—Fiftieth Annual Society of the Motor Industry, National Radio & Vacuum Conference, Statler Hotel, Washington, D. C.
- Mar. 19-21—Ninth Annual Conference, Society of the Plastics Industry, Canada Inc., General Hotel, Niagara Falls, Canada.
- Mar. 19-23—National Production Forum of the SAE, Hotel Statler, Cleveland, O.
- Mar. 21-Apr. 2—Fifth International Magazine Publishers, National Council American, Washington, D. C.
- Apr. 4-12—Second Annual International Motor Sports Show, Grand Central Palace, New York, N. Y.
- Apr. 12-15—Automatic Production Forum, National Automatic Meeting and Aircraft Engineering Display (SAE), Hotel Commerce Union and Hotel Statler, New York, N. Y.
- May 12-14-15—National Conference on Airborne Electronics Dayton Edison Hotel, Dayton, O.
- May 18-21—Fifth National Materials Handling Symposium, Commodore Hall, Philadelphia.
- June 9-11—Second International Aviation Trade Show, Hotel Statler, New York, N. Y.
- Oct. 16—International Air Race, England to Chatham, N. Z., entry deadline Jan. 11.
- Sept. 5-13-1958 SEAC Convention Two Flying Displays, Fairbanks, Hampshire Sept. 16-17—Fourth Anglo-American Joint Technical Conference, London.

PICTURE CREDITS

1—Bernard Weiss; 2—Doris, Airphoto Co.; 14—Lindberg; 15—McGowan; 16—Walters; 17-18—Lindberg; 19—McGowan; 20—Walters; 21—Walters; 22—Walters; 23—Walters; 24—Walters; 25—Walters; 26—Walters; 27—Walters; 28—Walters; 29—Walters; 30—Walters; 31—Walters; 32—Walters; 33—Walters; 34—Walters; 35—Walters; 36—Walters; 37—Walters; 38—Walters; 39—Walters; 40—Walters; 41—Walters; 42—Walters; 43—Walters; 44—Walters; 45—Walters; 46—Walters; 47—Walters; 48—Walters; 49—Walters; 50—Walters; 51—Walters; 52—Walters; 53—Walters; 54—Walters; 55—Walters; 56—Walters; 57—Walters; 58—Walters; 59—Walters; 60—Walters; 61—Walters; 62—Walters; 63—Walters; 64—Walters; 65—Walters; 66—Walters; 67—Walters; 68—Walters; 69—Walters; 70—Walters; 71—Walters; 72—Walters; 73—Walters; 74—Walters; 75—Walters; 76—Walters; 77—Walters; 78—Walters; 79—Walters; 80—Walters; 81—Walters; 82—Walters; 83—Walters; 84—Walters; 85—Walters; 86—Walters; 87—Walters; 88—Walters; 89—Walters; 90—Walters; 91—Walters; 92—Walters; 93—Walters; 94—Walters; 95—Walters; 96—Walters; 97—Walters; 98—Walters; 99—Walters; 100—Walters.

How



Tekwood®
lightens
shipping costs

Tekwood is light yet it's strong!

Its remarkably high-strength, low-weight ratio (due to its knif paper-and-hardwood plywood-type construction) means you can ship with less weight at lower transportation costs. Strong, tough Tekwood also gives noise protection for your aircraft parts.

Tekwood lowers labor costs, too. Tekwood can be worked more quickly and easily. Its smooth surfaces act as a built-in liner. Cuts cleanly to any shape or size. Won't splinter, buckle or split. And it takes staining beautifully.

What's more, Tekwood is low in cost.

Many of the leading aircraft parts manufacturers rely on Tekwood to lighten their cost loads. Investigate Tekwood for yourself. Mail coupon below.

UNITED STATES PLYWOOD CORPORATION

35 West 44th Street, New York 36, N. Y.
World's Largest Plywood Corporation

Manufacturers of Plywood and Veneer
Products in a variety of grades
U. S. Ply. Co. OFFICE
Write now, please.

UNITED STATES PLYWOOD CORPORATION

35 West 44th Street, New York 36, N. Y.
Yes, please send me a Tekwood sample and the up-to-date literature data.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



Boeing YB-52 Stratofort Heads 'Upstairs'

With its eight powerful P8WA J57 light-compressor turbojet engines, the mighty Boeing YB-52 Stratofortress takes off from Boeing Field, Seattle, Wash., as one of its most remarkable sights. This unusual photo sequence gives the reader the impression he is standing near the runway



as the plane gets off the ground, gradually backs on its eight main wheels and two outriggers, and then flares just into the sky. The lack of a noisy engine exhaust is noteworthy. USAF has ordered the Boeing boomer into production at Seattle.



Remington Rand Methods News

Let's talk control methods at Cleveland Maintenance Show

Many types of effective records for maintenance control can be studied at Booths 507 and 511, *Positive Analysis*, Jan. 19-22

For profitable new approaches to the maintenance problems of a maintenance department, there's nothing like seeing how other firms get results. About the Maintenance Show, we will introduce to you a new idea in maintenance control — demonstrated for the first time anywhere.

And, naturally, we will show you many of the production and maintenance control methods described in our new book, *Positive Analysis*. If you wish to visit with us in Cleveland, be sure to stand among the helpful literature on subjects of interest to you.



Look to your preventive maintenance record for help in keeping plant output at peak

As production equipment grows more complicated, a breakdown becomes more costly. Preventive maintenance control is more vital than ever for plant efficiency. Your records must help justify the following — or else!

Maintenance superintendents who have a healthy hatred for paperwork advise that our simplified viable methods which give maintenance control with minimum effort work.



These methods visually signal the next inspection date for every piece of equipment; tell what inspection is needed; permit scheduling of work ahead. Every man's time will be planned for maximum efficiency. Maintenance work loads can be stabilized.

Also, these methods eliminate the guesswork on proper intervals between inspections. Decisions can be made on the basis of actual experience for each type of equipment.

Likewise, the methods help the responsibility for an unsatisfactory breakdown, revealing whether the failure was due to operator abuse or careless maintenance work.

The plant manager gets all the facts for determining when it will pay to replace a part or machine. He has a complete and convenient history of servicing and repair costs, as well as depreciation on the equipment.

These methods are flexible, can be adapted to your own special needs. See how they have been used in with preventive maintenance manuals, adapted to special types of equipment such as electric motors, etc.

Study the procedures and methods as well as preventive maintenance and property records used successfully in many well-known plants. Ask for folders K-604 and K-606, also for methods the MCHT-700 which is available on a test day basis.

Get better maintenance from smaller inventory

There's a firm of 2,000 employees operating on a total maintenance inventory of only \$100,000 which turns over at the rate of nine times a year. What's more, they don't have to worry about running short of new parts or material needed to keep the machines running.

This other-report was made possible by controlling the inventory records and the purchasing of maintenance supplies under a control system which Remington Rand designed and installed.

Previously, individual department heads had done much of their own buying. This led to wasteful duplication of stocks. Likewise, they poured up the valuable variety of valuable parts because each plant bought from its own sources. Now could they get the service which comes with planned buying?

Previously, an entire department might be shut down for lack of a single part in the stockroom when it was needed. Now the stocks control fall below a safe minimum on any stock without management knowing about it.

Let us show you how such a system can work for small plants or large — with maximum paperwork. Ask for our new methods file MC-606.

QUICK RELIEF FOR COMMON MAINTENANCE HEADACHES

A small part can give you a big pain — when it's the wrong part. Free description of parts and materials brings all kinds of trouble, shortages and repair delays, duplications and overcharges. But the one to identify, identify and identify each item properly, it can be referred to an expert number at every step. Using this charting to control. See how our diagram here helped other firms accomplish this of maximum cost. Ask for booklet E-30-30.

Remington Rand

Management Service Bureau, Inc.
Room 7115, 440 Lexington Ave., New York 17

Please write the literature you desire
S-1268 K-604-65 K-606-10
NY-737 NY-502 IND-10

Name _____
Title _____
Firm _____
Address _____
City _____

WHO'S WHERE

In the Front Office

George R. Bell has been named a vice president of Curtiss-Wright Corp., West Ridge, N. J. He will continue his duties as controller a part he has held since 1949.

Gen. Russell R. Keady has been appointed president of American's smallest aircraft manufacturing plant at Lockheed Air Terminal, Burbank, Calif. Gen. Raulo's aviation background goes back to 1923. He was in the Air Force from then to November 1949 when he retired.

Arthur H. Kahan has been designated vice president-engineer of the Al-Judah Corp., Philadelphia, Pa., mechanical engineers for the USAF and industry.

High Lehnman and John Kowall have been elected vice presidents of Chrysler's Chrysler Lehnman will continue in charge of production for aviation industrial test equipment and all hydraulic equipment. Kowall will continue as general manager and will direct the aircraft and development division. David Friedman has been named controller and administrative assistant to the treasurer.

Burghard W. Tansy has been elected a vice president of Pan American World Airways, with headquarters in Rio de Janeiro. Tansy has been the Latin American division since 1946. Tansy will be succeeded in that post by Edward Deschenes, a former aviation man. Edward R. Carr, vice president of Pacific Airline division, has been elected vice president of PAA's Atlantic division. Vice President Clarence M. Young has succeeded Carr as the PAA post.

Changes

John Roberts has been designated engineering manager for Fairchild Aviation Corp., Los Angeles.

Robert W. Woodhouse has been appointed general sales manager for the Pratt & Whitney Corp. His services post in connection with the sales effort have been filed by William A. Stokes. Stokes Thomas has been assigned to combined functions of sales manager, service and technical sales.

Frederic H. Hall has been named general manager for General Electric Co.'s General department of Scientific, N. Y. James W. Goble has been appointed manager of engineering in this section.

Joseph H. Rice, Jr., has been designated general manager and chairman of the board of Rockwell International, San Carlos, Calif., maker of military aircraft and special instrumentation and electronic systems.

Honors and Elections

Van Alstede Emory S. Land has been elected the Vice Admiral "Terry" Land medal is a new honor given for the first time this year by the Society of Naval Architects and Marine Engineers. The medal was presented to Adm. Land for his accomplishments as chairman of the old aviation commission and of the War Shipping Administration.

INDUSTRY OBSERVER

Corsair officials say not know it yet but a production contract is being processed at An Aircraft Company and Headquarters for a possible number of multi-engine supersonic fighters to be built in Corsair's Ft. Worth plant. USAF order for the Corsair supersonic fighter was issued last month on the subject by Undersecretary Ronald R. Galt, who last August and "other essential work" would be included in the Ft. Worth plant as "substantial" quantity when B-56 production plant set there in 1954 (Aviation Week Aug. 4, p. 69). Being was the Corsair competitor for the supersonic fighter contract.

General Motors Corp. officials are pleased over the recent CAA proposal to include flight testing of their Allison Division Turbo-Lane as a proposed final 1954 jet transport program. Part of CAA's proposed \$1.5-million budget request to develop test and safety data for jet airplanes is an idea for 75 hr. of safety flight testing the Turbo-Lane at \$1,500 an hour and another 75 hr. of operational flight testing at \$1,000 an hour. The Turbo-Lane is a Corsair 240 engines powered by two Allison T38 turbojets.

Watch for an expansion of Flight Refueling, Inc., of Danbury, Conn. Both USAF and Navy are counting heavily on its "probe and drape" method of refueling in their future operational plans. Radar-guided capital probably will be expanded to expand operations in the same Generalized line to meet military production requirements. Latest test of the equipment has been in a Convair B-36 modified in a tanker to refuel Boeing B-47 bombers in flight.

Bitter controversy between United Air Lines and most of the other large U.S. airlines on the issue of high vs. low-density seating is being carried over into the jet transport field. UAL is the sole holdout against high-density seating for U.S. jet transport designs. All other airlines seriously interested in operating jet airplanes are pushing for increased seating capacity in the hope to profitable jet transport operations. Since UAL is a large equipment owner, U.S. aircraft manufacturers are reluctant to upset its demands.

Experiments with probe plotting in a modified Lockheed F-80 by USAF and the Standard Aviation Co. of Red Bank, Penn. proved that probe plotting can operate at very low altitudes, possibly as low as 20 ft. with no ill effects. Interest in probe plotting (PI) is extremely high because of the advantages it offers in solving the difficult canopy problem of aircraft at speeds of Mach 1.5 and above.

Both the Vietnam transport version of the upcoming Vietnam bomber and America's own version based on the delta Vulture bomber configuration are being tested at a speed of about 100 passengers. By Ray Doherty, two dual executives, there the jet airplane version of the Vulture could make three roundtrips a day between New York and Port of Spain with 170 passengers. BANC is studying Vietnam transports.

American Express and Import Co. of Miami has signed a USAF contract to be B-450-51 jet engine engines from the Pratt & Whitney Aircraft factory at Fort Hartford, Conn., at Corsair's Ft. Worth plant in its C-46 plant. The 3,500-hp. engine engines are used in the latest models of the B-450 bomber. On order flight from Ft. Worth, AMICO will build aircraft parts from Tulsa, Ark. (Oklahoma City) to Westover AFB, Sdcard or Newark. Contract calls for a minimum of 50,000 an hour per engine a month with a maximum not over 91,000 miles.

Ryan Aeronautical Co. has received its second contract for research and development on turbine applications for aircraft structures. Under contract from the Navy will be manufacturing and testing of a large number of typical aircraft structural parts made of titanium. Under USAF contract will be titanium processing methods suitable for application to aircraft engine exhaust systems.

gear programs W. L. Jack Nelson, first secretary of the Personal Flying Department (Advisory Committee, his successor, H. Lloyd Chalk, and Dr. Dean Robinson) whose research had been an important factor in releasing medical requirements for private pilot licenses.

Mass credit to GAO during its short lifespan goes far in part to development of the CAA sponsored AG-1 significant experimental plane designed by Prof. Fred E. Weick at Texas A&M College with industry cooperation, or was later built and flight-demonstrated to agricultural operators across the country.

Features of the plane and its spraying and dusting systems are expected to appear in some forthcoming commercial produced agricultural plane, but there has been announcement of a plan to build a plane essentially similar to the AG-1 model.

Prop Wash Causes Lightplane Crashes

(McGraw-Hill World News)

LONDON—The Ministry of Civil Aviation claims that in the past few months it has had "numerous cases" of light airplanes being control after running into turbulence created by the propeller wash of large jet transports.

A case in point, NACA's accident in capturing birds since, occurred at London Airport Aug. 1. A D-81 Rapide biplane, operating pleasure flights for a London firm, was cleared to land behind a Stratosphere Approaching at 300 ft and 100 mph and starting a turn, the Rapide ran into severe turbulence and went out of control.

"In a rapid movement," the report says, "the aircraft was lifted to the right as its wing lost and violently control several times. The pilot immediately increased engine power to regain control, but the aircraft was now thrown violently to the left, still on an even keel. It then started to lose height rapidly."

In the trailing roads, five of nine passengers were injured.

Referring to other similar crashes investigated subsequently, the report says, "Small aircraft have encountered turbulence of such a nature at distances exceeding one mile from other aircraft. It appears that in conditions of this sort the turbulence is likely to persist over the ground for an appreciable length of time."

All-Women Air Race

The AB-Women Transcontinental Air Race will be held Jan. 1-5 next year, starting at Lawrence, Mass., terminating at Long Beach, Calif.

Navy Confirms Aircraft Cutbacks

F9F-6, AD-5 and FJ-2 programs trimmed heavily under Defense prodding to phase out obsolescing types.

Navy last week confirmed American West's exclusive story of Nov. 24 on announced production cutbacks in Navy contracts with Grumman Aircraft Engineering Corp., Douglas Aircraft Co., Inc. and North American Aviation, Inc. Navy also confirmed that the cutbacks were made in a spirit of prodding by Defense Secretary Robert Lovett to phase out production of all rapidly obsolescing military aircraft before the end of 1954.

Earlier, USAF had confirmed that its Lockheed Strife (P-94C) and Mustang Scorpion (P-39) production programs also had been cut back as reported in American West (Nov. 24, p. 14 and Dec. 1, p. 7).

The Navy announced cutbacks are:

- **Continued.** Production of the swept wing Corsair (F9F-8) is reduced by 35%. Better still, a second Corsair had been programmed, this represents a heavy slash in Grumman's production plans. Only the F9F-6 program has been cut. This version is powered by an advanced version of the Pratt & Whitney J45 centrifugal flow turbojet. A relatively small quantity of F9F-6s powered by an advanced version of the Allison J35 turbojet will be retained as the production program.

- **Douglas.** Production of the Skyraider AD-5 is reduced by 15%. This version still carries orders for the Navy but has set a new standard of military performance for piston-powered aircraft both in carrying a 6,400 lb. bomb load (just less than the World War II load of a B-17) regularly off carrier decks and in durability under combat fire. Special version of the Skyraider equipped with radar and weather-avoiding gear will continue to meet service long after the attack versions have been replaced by more modern turbojet-powered aircraft.

- **North American.** Production of the F-86F has been reduced by 33%. American West subsequently reported earlier that the North American cut would extend to Savage (A-1) production. The FJ-2 is the Navy's version of the USAF F-86 (F-86C). First production version of the F-86 is scheduled to be delivered from North American's California, Calif. plant in December.

- **Defense Request.** The cutbacks concern aircraft largely scheduled to be delivered during the last half of 1954 although a few major deliveries are delayed. All production work now in progress will be continued on these three types. Navy emphasized that the

cutbacks had been implemented because of a Defense Department request to cut back contracts for production of aircraft that were facing a relatively short life in light of new aircraft and that might be placed on bringing more modern types into production quickly.

Obvious result: reduction of the Navy to make the cuts since it will have smaller, older fleet modern aircraft types (those originally scheduled because of the increased cost of the newer types). These cutbacks will also delay the last aircraft modernization program because the newer types will be available later and in smaller quantities.

Weight Limits Up For Army Aircraft

Weight limitations in Army field manuals have been lifted and the allowable empty weight of field-use aircraft doubled, according to a new agreement between the Army and the Air Force.

The new agreement sets a limit of 7,000 lb. empty weight on Army field-use aircraft. It stipulates that the weight limitations previously will be increased on request of the Secretary of the Army or Secretary of the Air Force to keep the limitations "realistic."

Previous limitations were imposed by a joint Army-Air Force committee that restricted field-use aircraft for a gross weight of 2,500 lb. and helicopters to 4,000 lb. Those limitations have been a source of criticism by many Army service adherents. The new agreement is considered a long step forward by Army aviation.

Ideal solution, they say, would be to relax the limitations outside use of functions, without any specific weight provisions. There is hope that this may be achieved later at the next step in the trial growth of Army aviation.

The latest in the series of conversations between Army and Air Force over the roles and types of aircraft that could will open—defers heavy Army functions at a later date for permanent cooperation.

- **Observation** to locate, identify and evaluate targets, including limited aerial photography.
- **Control** of Army forces.
- **Command**, control and liaison missions in combat zone and beyond.
- **Aerial** base flying in the combat zone.
- **Transporting** supplies, equipment, personnel and small units in the combat zone.
- **Armored** reconnaissance in the combat zone.
- **Artillery** and topographical survey.
- **Air Force** will continue to provide their air transport for Army.
- **Airfield** of supplies, equipment, personnel.

and aircraft, lines outside to within the combat zone.

- **Ability** to evacuate personnel and material from the combat zone.
- **Artillery** fire support, supplies and equipment in transit and subsequent airborne operations.

- **Armored** reconnaissance from the combat point of tactical or logistical basis to provide outside the combat zone, and transport, maintenance of all combat units in airborne operations, until ground backup is attained.

Faster Delivery

• **New inspection of engines cuts costs and time.**

• **Method proves successful at P&W and GE plants.**

Navy and Air Force are getting better delivery of aircraft engines at lower cost as a result of a new method of inspection and acceptance testing.

Already adopted successfully at Pratt & Whitney Aircraft's East Hartford plant and General Electric's West Lynn plant, the services are planning its early extension to Allison at Indianapolis and Westinghouse at Kansas City.

President-Electric has in how the plan works (full details in American West, Aug. 6, p. 213).

As control batch of 125 engines is run through normal acceptance procedures with a gross test run, non-destructive inspection after the gross run, is completed and gives a final test run. If no more than one major defect, sufficient to cause engine failure or malfunctioning is found in the usual batch of 125 engines the gross run, test-run, inspection and is automatically eliminated.

For one cost of every four engines until 75 more engines have been built down and inspected.

If all agree that one major defect is found in the batch the rate is increased to one out of four engines until an additional 75 engines have been inspected. If this problem no more than a single major defect, the inspection procedure continues at a rate of one to 10.

Whenever a second defect is found in any gross batch of engines before 75 engines have been run down, the inspection rate is returned to the next lower level.

In the Navy version, this reduction is optional at the discretion of the receiver plant inspection and depending on the type of defect discovered. In the Air Force plan, this reduction is mandatory. Total of 525 engines must have passed the statistical sampling method before the 3-out-of-10 inspection rate can be applied.

Results show what the plan has accomplished:

- **Saves money.** Navy figures show that P&W has used an average of \$650 per engine on oil, fuel and labor loss under the new plan. Additional savings result from elimination of replacement parts discarded during the test-down and inspection. At GE, the Air Force says gross savings average \$450 per engine with an expected increase to \$500 some.
- **Speeds delivery.** Time saved by elimination of the gross test run (including about three hours) plus test down, inspection and re-assembly increases the delivery capacity of any specific plant substantially. In addition, test labor is required to handle an accelerated delivery schedule.
- **Conserves test facilities.** Engine test cells, particularly for jets, have been a bottleneck ever since the post-Korean production expansion began. Elimination of the gross run cuts test cell time.



UNDERNEATH THE STARFIGHTER

Lockheed F-96 Starfighter flies over its post wing, providing a detailed plan view of its underside. Note the most important detail, fitted with leading edge droop doors. The second all-weather USAF interceptor

designed to meet enemy aircraft which can be electronically sensed and fired without the crew seeing the target. Equipped with a P&W J45 jet with afterburner providing about 9,000 lb. thrust.



NEW ITALIAN ADVANCED TRAINER

New plane, North's M-8 323 advanced trainer has been designed as a complete replacement for the British jet trainer. It will compare with the P-51 Mustang and the C-47 as a production trainer. The M-8 323 is powered by a P&W R3340 of 550

horsepower and has a top speed of approximately 350 mph. In flight duration a 5.2 hr. Commission is at all times. The large winged canopy provides good visibility. The landing gear also can be fixed on the track.

required for nine out of ten engines in half.

The stabilized ramjet engine was originally developed by the Navy at R&W in 1953 as an emergency measure to spend deliveries on the J42 turbojet by using a production test cell left over from the J42 turbojet. It worked out well and at the end of J42 production it was extended to cover the B4350 and B2300 piston engines as the successor of 1953.

The J42 was included in the plan in June of 1953 and after it had passed through a period of component design, this engine reached the 1-in-10 inspection level in October.

The Air Force began using the plan at General Electric's West Lynn plant on the B4353 and J42-23 test bed and reached a rate of one in 10 in September.

The Navy also used the plan for its ramjet with the Westinghouse J34 engine in the Bureau City plant but abandoned it because of production problems there.

Short Bros. Cites Need for Jet Orders

(McGraw-Hill World News)

London—The first English Electric Canberra jet bomber to be built by Short Bros. & Holand of Belfast has made its maiden flight. Short's chairman, Rear Admiral M. S. Slattery, took the opportunity to make a complaint. Unlike most British aircraft companies, he had labor, machines, and production capacity, but he needed more orders badly.

Short Bros. is also advertising production of the Series 3 Comet, but Admiral Slattery said he only has orders for 15 so far.

The first of these would be made by the summer of 1954 and by the end of 1955 but plant would be in a position to have one out a week if the orders were forthcoming.

So far only about 12 Series 3 Comets have been ordered, and last week de Havilland announced that a new Comet production line was being planned at Bovingdon, near Chichester. de Havilland's biggest production unit, now making Venoms, Hornets, Doves and Comet parts.

de Havilland is confident further orders for Comet 3s will be forthcoming and large orders for Comet 4. Production of the last of 31 Series 3 Comets is almost in sight at the de Havilland production line in Hatfield, Hert.

With orders, Adm. Slattery thinks, "We can produce the aircraft as well and as quickly as the U. S. can, and at much less cost." Short Bros. is one of three companies in subcontracting produc-

tion of the Canberra A. V. Roe and Handley Page have not to announce their last production model. Slattery's remarks indicate that the Canberra orders in the three subcontracting plants are small, perhaps in the neighborhood of 100 each.

Short Bros., according to Slattery, is one of the few British aircraft plants which have a welding and able to work day and night shifts. He figured most British aircraft factories worked only 8 or 10 hours a day.

Short also builds the S.4.4 four-jet bomber, the second model of which flew for the first time last summer.

World Aircoach

- IATA conference plans global service by 1954.
- Europe-wide network to commence next April.

Worldwide aircoach service is expected to become a reality by Apr. 1, 1954, as a result of agreements reached by member airlines of the International Air Transport Association (IATA) at recent conferences in Geneva, France.

Approval of a network of air coach services throughout Europe, expected to go into operation next Apr. 1, will be the first big preliminary step toward globalizing aircoach.

Deane D. Haudeville, conference chairman, stressed "almost an economic revolution in air transport" and added that by the time the new services have become fully operational "the major portion of international air passenger traffic will be carried on tourist rather than first-class flights and the economic basis of the industry will be seen rather than deluxe transport."

Calendar—The 67 member airlines from about 30 countries which comprise the IATA Traffic Conference made policy on questions of international fares, rates and other tariff matters in a series of sessions which are subject to approval of their respective governments.

The extension of aircoach extension decided on by the conference:

- Apr. 1, 1953. Tourist services between Europe and the Middle East—Amman, Beirut, Cairo, Damascus, Haifa, Jerusalem, Tel Aviv and Cyprus.
- Oct. 1, 1953. The network will be extended from the Middle East to India, Pakistan and Ceylon, and from Europe and the Middle East to South Africa.
- Apr. 1, 1954. Aircoach will reach Hong Kong, Manila, Tokyo, Australia and across the Pacific to South America, San Francisco and Vancouver.

to link up with Western Hemisphere networks and trans-Atlantic routes.

It is expected that when this program becomes a reality, about half of the international passenger fleet of 2,500 planes will be converted to high-density aircraft seating.

Fares will vary little more to make head to tail that most airlines' fares will be about 20 to 25% less than first class fares. Present aircoach and first-class fares in the Western Hemisphere and over the Atlantic are expected to remain about the same. A third class, called "Class B," is expected to be about 10% below tourist rates and is planned for the Far East, the Middle East and the West African routes.

There will be no appreciable change in cargo rates throughout the period of this agreement, but plans to increase cargo tonnage across the Atlantic will be discussed at a special meeting of IATA in February. The next traffic conference will be held in November 1955.

New South Africa Services Sought

(McGraw-Hill World News)

Johannesburg—A number of new operators are seeking to crack the passenger and freight market held by British Overseas Airways Corp. and South African Airways on the Rhodesian frontier.

Recent applications have been made to the General African Air Authority by several independent airlines who claim they will cut prices from 40%.

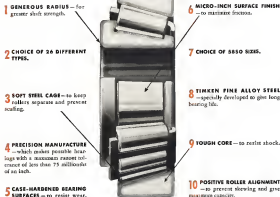
First new operator to get a license is Flying Air Transport Co., London, now operating to Nairobi. Airways Ltd. has applied for a London Salisbury route using Vickers Viking and Handley Page Hermes transports. Skyways Ltd. is seeking an aircoach run by use of Moslems, Nomads, Karroos, Wash, Bantu, Cyprus and Malta to London. Tropical Airways is applying for a service from Cape Town to New York via New Salisbury with Douglas Dauntless.

Jets for Cotton?

(McGraw-Hill World News)

Rio de Janeiro—A deal whereby Brazil would build \$14 million worth of cotton is under the 76 Gloster Meteor jet planes apparently has run into serious difficulties. The Bank of Brazil does not have sufficient stocks of the petroleum grade of cotton the British want and there also is some disagreement as to how much it's worth.

If you want all this in a tapered roller bearing ...



... the tapered roller bearing you want is TIMKEN®

TIMKEN® tapered roller bearings give you more advantages than any other make. Ten of these advantages are listed above. They result from the fact that the Timken Company is the foremost producer of tapered roller bearings and leads in 1) advanced design, 2) precision manufacture, 3) rigid quality control, and 4) special analysis tests.

Be sure every tapered roller bearing you use carries

the name "Timken", the trade-mark of The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMRQSCO".

TIMKEN
TAPERED ROLLER BEARINGS



NOT JUST A BALL • NOT JUST A ROLLER • THE TIMKEN TAPERED ROLLER BEARING • BEARING LAMES RADII • ONE THRESH • LOSE OF ANY COMBINATION

PRODUCTION ENGINEERING



FLAREOUT

Leading of production HTK-1s during flight tests shows a Kaman Navy copter's new profile. The roll ended out of the Kaman Aircraft Corp. K-125 aviation helicopter.



NAVY SERVICE

Swain tests production HTK-1s after flight tests at Kaman's Windsor Locks plant. One copter is undergoing stability tests by Army Ground Forces at Ft. Rags.

Kaman HTK-1 Copters Roll Out for Navy

Kaman's 2.5-place HTK-1, probably the world's only autonomous type lift copter in full production, is moving through the firm's Windsor Locks, Conn., plant as an amphibious assault helicopter. The Navy and Marine Corps, and one of the copters is undergoing stability tests by the Army Ground Forces at Ft. Rags, N.C.

Basically a training craft, the HTK-1 can only be adapted to medical evacuation duties—the left half of the cargo opening is used to facilitate loading of litters.

The HTK started out as a military version of the Kaman K-125 civilian copter, but finally evolved into an en-

tirely new design, in which the interconnecting system and Kaman servo-bid control system were retained.

► **Design Changes**—Several major modifications set the production HTK-1 apart from the prototype HTK which made its debut at the Helicopter Forum in April 1959.

Changes include decreased tailboom, added fuselage, and aerodynamic changes in the rotor blades. Shortening the tailboom caused a loss of tail moment wing, so the area of the outboard fins was increased from 108 sq. ft. to 124 sq. ft., and vertical and dorsal fins, each of 14 sq. ft., were added on the tailboom.

The prototype HTK made its origi-

nal appearance with a pair of K-125 rotor blades, which have equal chord throughout. But the production HTK-1 has newly designed blades that are narrower than the old blades, widening at the inner hub, and tapering toward the tip.

The flexible blades are actuated by the servo-bid, a distinctive Kaman feature.

The HTK-1 recently received FAA approved type certificate 1183 (Navy, in its contract award to Kaman, specified a craft as designed and constructed as to be certificated). Commercial designation of the new helicopter will be K-140.

At present, Kaman has slightly over



1 HTK-1 fuselage starts with main rotor assembly which are put on the main fuselage (left), and welded to form main frame (right).



2 Engine, transmission, controls, and electrical and instrument lines are installed. Shock struts of landing gear are installed.



3 The tailboom is made here. The boom is aluminum, as is the innermost stabilizer and part of the control and rotor fins.



4 Cockpit furnishings and the tailboom, with its outboard fins attached, are added. The engine is then checked for an hour.



5 Blade installation is made outdoors on other days. After flight test, crew gets Navy point job. To get copter inside point ship, copter must be removed. They are worked, for return to same hub they was attached to during flight test.



NEW STANDARD D-C CONTROL PANEL BUILT TO USAF EXHIBIT No. MCREXE22-89A

Here is the new standard d-c control panel. This compact lightweight panel embodies outstanding Westinghouse contributions in the regulation, control, protection and maintenance of d-c aircraft systems.

Many of the built-in features are the result of successful use in other Westinghouse panel designs... your guarantee of performance-proved equipment.

The new panel is of the single plug-in type with a voltage regulator which can be quickly inserted or removed. Vibrations and shock loadings are built into the unit around the center of gravity.

Accurate generator selectivity in a multi-generator system prevents hazards of generator overexcitation during cross-loads and overload conditions. Special design in the field relay provides trip-free operation... both mechanically and electrically.

For further information, call your nearest Westinghouse Office or write Westinghouse Electric Corporation, Aircraft Department, Lima, O. 43036



YOU CAN BE SURE... IF IT'S
Westinghouse

**AVIATION
EQUIPMENT**



CAPRONI'S LATEST is the little F-5 jet trainer, built of wood and powered by a Tufsoness F-6 engine. This aspect of the plane emphasizes the large area of fuselage for the cockpit, and shows off the jet installation.

Italian Jet Plane Aims at Economy

Latest in lightweight jet trainers is the F-5, a plywood, low-wing, tandem plane developed by the Italian firm of Aero Caproni Torino.

AGV designed and built the two-place tandem trainer for novice and novice pilot schooling, strong at a plane that would be economical to build and operate. That general consideration led to use of a conventional airplane geometry, a proven Tufsoness F-6 turbo-prop engine and all wood construction.

► **Structural Details**—The wing is built around a one-piece box spar with laminated Douglas fir walls and balsa plywood webs. Covering is plywood.

The forward support for the landing gear leg is on a secondary wing spar, that member also serves to attach wing box into the fuselage.

Flops and ailerons are carried on a rear fuselage. Flaps are operated by dual-cable for hand pump.

The fuselage is divided into two sections. Forward, containing cockpit, operating gear and aileron, is integral with the wing root, with jet air ducts and fuel assembly. Both fuselage and wing sections together.

Fuselage is built up of dural and box frames, covered with birch plywood.

Tail surfaces are similar to the wings in construction details. Fin and rudder form part of the fuselage and are covered with birch plywood. Rudder and elevator are fabric covered.

► **Landing Gear**—Main landing gear leg of the fuselage undercarriage is hinged to the secondary wing spar and extends into the wing. Nose wheel leg uses a longstroke shock absorber; it extends back into the fuselage. Part of the nose wheel remains outside the fuselage contour, so that it is a wheel-up landing; the fuselage and jet will not protrude. The function of the gear is mechanical.

An air brake, operated with a hand wheel, is fitted to the fuselage belly. It increases the overall drag without much change in pitching moment.

Noteworthy features of the cockpit design is the large amount of fuselage canopy area provided. Visibility should be excellent from either seat. The canopy can be opened in flight, in the event of trouble.

The forward position is for the student, and contains all the necessary instruments for flight and operation of the aircraft. The rear position, for the instructor, has only three instruments; the instructor must peer over the student's shoulder to see the rest of the instruments.

► **Installation**—There are two fuel tanks, one at position for engine starting and use for leaner. The preflame tank is located inside the fuselage and holds



Caproni F-5 Trainer

NEW
and practical answer
to many special
communication
problems



WHEELER
SOUND POWERED

Electric

TELEPHONES & HANDSETS

• Clear, undistorted speech with standard or new type high efficiency sound power

• NO BATTERIES... NO OUTSIDE power source

• Ideal for repairs, no maintenance

• Many possible sound modulations... but no visual display, rotary speed controls, horns, lights, etc.

• High level standards for sound quality

• Ideal for emergency services

• Insights welcomed for special or modified units or systems

the WHEELER

INSULATED WIRE CO., Inc.
DIVISION OF THE SPERRY CORP.
1124 EAST AURORA ST.
WATERBURY, CONNECTICUT

Bourns



LINEAR MOTION POTENTIOMETERS

Bourne precision wire-wound potentiometers accurately translate mechanical position into an electrical signal. Resolution of .001 inch attainable in all standard ranges from 1 to 6 inches.

Technical publications describing standard models and special applications available upon request.

Bourne designs and manufactures other potentiometer instruments which measure such physical variables as gage pressure, differential pressure, altitude and acceleration.



Bourne LABORATORIES

6135 MAGNOLIA AVENUE • RIVERSIDE, CALIFORNIA

only 1.3 gal, the Hercules tank holds 35.8 gal and is located on the airplane GC, just behind the second seat.

It is possible to access the fuel capacity by using nylon rubber tanks interable in the wings, or with auxiliary wing tanks. An alternate tank can be installed in place of the outboard for long navigational training flights.

Fuel and lubrication systems are designed for inverted flight.

The electrical system is 24-v., battery-supplied. An outside trailer is supplied for starting the jet engine.

Radio is a VHF transmitter-receiver.

Fire extinguishing system is carbon dioxide, operated by the first pilot.

The Tachometer Plus has a stroke throat of 180 lb. It is located behind the wing in the rear fuselage belly, jet exhaust is directed straight out, firewall insulation is done with glass wool.

Performance—Maximum speed of the P-5 at sea level is 234 mph, and at 10,000 ft, 242 mph. Climb to 10,000 ft takes 23 min.

Takeoff run with flaps is 970 ft, without flaps is 1,260 ft. Landing run with brakes and flaps is 500 ft, without flaps is 793 ft.

Actual wing of the craft is 26,100 ft.

Wingspan of the P-5 is 25.8 ft., overall length, is 28.5 ft. Gross weight is 1,070 lb., and weight empty is 1,032 lb.

With a wing area of 107 sq. ft., the wing loading is about 15 psi. Fuel consumption is about 26 gph.

Scale-Model Tunnel Blows Big Wind

A scale model of the giant propulsion windmill being constructed at the Arnold Engineering Development Center, Tullahoma, Tenn., has been placed in operation.

Proposed in December 1955 by AEC, operating contractor of AEDC, the model transonic tunnel was designed, fabricated and operated on schedule.

Use of the tunnel will be in research on problems associated with the operation of its big brother. It will try out ideas for improvement and modification, and will test substitutes proposed for the big tunnel.

Power comes from a 3,000 hp electric motor which drives an air compressor rated at 100,000 rpm. A portion of the air is recirculated through the compressor before it is admitted to the tunnel. This causes the operating temperature to rise, but condensation will not occur in the test section.

First section is one foot square, but speeds are listed as "over 1,200 mph."

The wind-tunnel tunnel is not a test

RYAN

Aircraft and Aeronautical Products



Ryan's Metal Products Division has taken the lead in solving one of the toughest problems facing the metals industry—that of making high temperature components that will better stand up to the intense heat developed in modern jet, piston and rocket engines. To do this, Ryan has assembled a staff of highly skilled, experienced metallurgical and machine engineers... and developed a physical plant equipped with some of the largest and finest precision machine tools in the industry.

Manufacturing components for the "hot spots" in present day piston engines requires the best equipment and most modern methods of forming, welding, precision machining and assembly. Ryan's follow-through service, development, and customer field testing experience, is conducted in the industry.



Metal Products Division • Jet Engine Components • Exhaust Systems • Rocket Assemblies

RYAN AERONAUTICAL COMPANY • LINDBERGH FIELD • SAN DIEGO, CALIF.

facility for windtunnel models, but a development tool for the big windtunnels. The original three units of the AEDC—engine test, gas dynamics and propellant combustion—are still not complete. The last of these was originally scheduled for shakedown tests in the spring of 1972.

Knit Glass Fabric Used for Radomes

Small production quantities of 25 domes for guided missiles and aircraft are now being made of woven glass cloth impregnated with resin. In this

recently developed process, the glass fiber is woven as draped knitting needles, similar to those used to knit women's half-finished hosiery. The resin is added either by the manufacturer or the purchaser. Models are not required. Molding of glass yarn on draped knitting machines has proved to be a tricky business, so glass-plastic structures until now have usually used the fiber in preform form.

The knit radomes are made by S. Gurnett Mfg. Co., 1481 High St., Central Falls, R. I. Gurnett receives 30 orders with the limited process to knuckle-grip in the construction of industrial fabrics.



Inflatable Steel Seal For Giant Air Valves

An inflatable steel seal is the unusual design feature of a family of butterfly valves for airway control, manufactured by the Henry Pratt Co.

Available in sizes from 36 in. to 165 in. in diameter, and suitable for temperatures ranging to 1,500°F, these valves are in use at Air Force, NASA and private contractor facilities which handle large volumes of heated high-pressure air.

► **Pressure-Sealed-Sealant** of the Pratt valve is a continuous stressed seal, made of stainless steel or Inconel X, welded to the inside of the valve body. This seal does not touch the valve disk during operation. But when the disk is in the fully closed position, the seal is so forced by fluid pressure, contacts the disk edge and eliminates an leakage past the disk.

On release of the seal pressure, the seal diffuses and the valve is ready for operation.

Pratt's development program started in 1945 with an Air Force contract for valves for the Arnold Engineering Development Center at Dayton, Tenn. Temperature requirements dictated the choice of using a rubber-sealed valve, and the wide temperature range made it impossible to use a conventional metal seat to get tight shutoff at all temperatures.

Operation of the valves may be by electric, air or hydraulic control, or by hydraulic or pneumatic cylinders. The valve disk itself (17-in. dia.) uses a Pyralox-Ger. World-Kemphre electric motor and water-gas inducer.

Pressure testing is successful at functions of valve seats. For large diameters and high pressures, the valve disk becomes disproportionately thick and one of the inherent advantages of the butterfly valve—low restriction to flow—is lost.

Valves between 36-in. and 60-in. di-



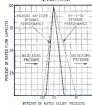
Vickers Model AA-3180-B
AN-6279-0C12



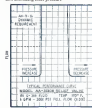
Vickers Model AA-3180-B
AN-6279-0C12



Vickers Model AA-3180-B
AN-6279-0C12



Pressure variation from cracking point to maximum rated capacity of Vickers Two-Port Balanced Piston Relief Valve is essentially less than permitted under Specification MIL-V-5523. Consequently less pressure adjustment is required between rated valve setting and unloading valve pressure.



Curve showing extremely low internal leakage of Vickers Two-Port Balanced Piston Relief Valve.

These VICKERS RELIEF VALVES TWO PORT • BALANCED PISTON Conform to Specification MIL-V-5523

The Vickers Two-Port Balanced Piston Relief Valves illustrated here conform to Specification MIL-V-5523. Their rated capacities (2, 5 and 9 gpm) are greater than required by this Specification (1.5, 3.5 and 6 gpm respectively).

The curves on the left illustrate two important characteristics of these valves: (1) very low pressure variation from cracking point to maximum rated capacity, and (2) extremely low internal leakage (less than required by Specification MIL-V-5523). Smoother operation and greater accuracy throughout a wide range of pressure adjustment are other significant advantages. Operating pressure range is adjustable from 500 to 4500 psi without parts change.

These valves are also available in four-gate models and can be provided with a vent control for unloading the system pressure. For further information about the complete line of Vickers Balanced Piston Relief Valves write for new Bulletin A-5204.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
14000 HAWKMAN BLVD. • DETROIT 32, MICH.

ENGINEERS AND BUILDERS OF MILITARY EQUIPMENT SINCE 1923

DEAN & BENSON RESEARCH, INC.

Serves the

AIRCRAFT INDUSTRY



The above engineering line—built by THE BUSHMAN MANUFACTURING COMPANY, KANSAS CITY, MISSOURI—has been replicated by DEAN & BENSON RESEARCH, INC. with two blades attached to eliminate transmission of vibration from the engine to the fuselage. This mounting is patented under U. S. Patent No. 3,432,087.

Designed for low weight, high torque and high aerodynamic efficiency, these fans not only supply all necessary engine cooling air, but also reduce air drag on the engine.



The two blades shown above is a part of all blades used in DEAN & BENSON RESEARCH, INC. design. These blades are available in plastic, aluminum or stainless steel.

DEAN & BENSON FACILITIES ARE DESIGNED FOR PROVING PERFORMANCE

Facilities Available for:

- Free Research
- Engine Cooling Testing
- Package Power Plants
- Power Plant Cooling Development

- Fan and Blower Calibration
- Oil Cooler and Corrosion Air Scoop Development and Testing
- Propeller Spinner and Blade Cell Research

DEAN & BENSON RESEARCH, INC.

16 Richardson Street

Cititron, New Jersey

Kansas City Office: 1811 Agnes Avenue, Kansas City 1, Missouri

Valve Talk

for WM. H. WHITTAKER CO., Ltd.

By Marvin Miller
Senior Analyst, Aviation Western Area



Stop and consider the problems you would face without the variety of valves, controls and the remote control systems offered by today's \$200,000,000-a-year aircraft valve industry.

Freight and ingenuity have made the valve business a vital component of aircraft production.

Many firms have tried and failed to produce valves, failing primarily because they underestimated the design and production skills necessary. They simply couldn't meet the increasingly high demands of aerospace and engine manufacturers—greater performance... reduced weight... smaller envelope...

But certain concerns could answer the demand, at far less weight and cost than could the answers had they chosen to try their hand at producing valves. They have become the established leaders in the valve business.

There are the companies that are so frequently mentioned in any talk with Whittaker people. Together with Whittaker, they have developed valves for every aircraft, perfected production techniques and established service standards that are appreciated by customers both here and abroad.

These outstanding companies not only have the perseverance and ability to create standard lines, containing in all—they have also devoted deeply into special jobs, working with each firm, so that between them they meet the widest possible range of demand.

And they meet it with the constant quality improvement and cost reduction that forces us to know how and specialization.

Invariably, competition between them is sharp. Whittaker neither underestimates nor underestimates its competitors. Rather, it recognizes their merits and acknowledges their role in advancing the industry.

Like Whittaker—the pride of the pressure in the field. Developer of the first hot air valves. Manufacturer of all types of valve equipment for cabin pressurization and temperature control. Highly regulated production and quality—no "rough competition." Whittaker may tell you.

Or Parker Appliances—another pioneer. For many the leader in the development of synthetic rubber seals (O-rings) that have played such a big part in the valve business. Widely known for its fuel selector and check valves, as well as for its single-

piece underwing refueling system.

Or Weston—specialists in difficult hydraulic problems and the precision of hydraulic components. A firm that will step into a particularly tough job, tackle it—and complete it—when no one else can.

Adel Precision—rival or rugged competitor by the size of Whittaker. Strong on standard lines of pilot and shut-off valves, also accessories. A big production firm devoted to perfection of high-demand units, and the maintenance of complete and reliable lines of equipment and weight.

General Controls—brings the experience of past industrial techniques to the valve business. Their high production standards have retained and improved control valves, compact ball valves and shut-off controls—even down to piston rods.

And Bendix Pacific—among the first to utilize an indicator that can be used for system selection, the well-known General motion to produce hydraulic controls. Manufacturer of wide range, from simple on-and-off valves to multiport products.

And Smith Brothers—known for fine custom work. Manufacturers of fuel check valves. Specialists in tapped-up production to AN Standards.

Also Hydro-Jacks—known for fuel filter, motor-operated, 400 cubic inch valve. For the solution of certain valve problems by hydraulic control. For use in aircraft with that permits maximum braking without skidding.

And there are many others...

There are the companies that have helped build the aircraft valve business into the solid, recognized industry it is today. These firms are so deep because their products are top.

The Whittaker Company respects its competitors.

units are 100-lb pressure rating, up to 100-in. dia., and valves are 200-lb. rating.

Manufacturer's address is 2222 S. Halsted St., Chicago 8, Ill.

New De-Icing Setup For 'Ice Wagon'

Ice formation will cripple the de-icing equipment soon to be installed on the "Rockwell Ice Wagon," Canadian icing research aircraft. Until now, de-icing equipment has been operated by a timing device rather than by actual observation of ice.

Those behind the new equipment was developed by Canada's National Aeronautics Establishment, design and engineering were done by Goodwin Tice & Baskley Co.

The new de-icing gun will be installed on wing, fuselage and stabilizer leading edges of the Ice Wagon, to complement the Goodwin modification already on the propeller and fuselage dorsal fin.

The plane is the fourth to come in NAE's studies, earlier versions having outfitted their predecessors. Its purpose is to try out ideas of using ice accumulators and to compare methods of removal. Research requires travel on the flights and work out problems as they occur, instead of waiting for the crew to return with data.

The Ice Wagon is a modified Douglas DC-3M, built under license by Canadian Ltd., Montreal.

Battelle Building German Center

Metallurgical and engineering research to help better Europe's economy will be one of the prime purposes of the new Battelle Munster Institute for Germany, scheduled to be opened in late spring, 1973.

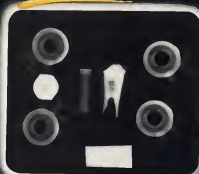
The new facility is being built at Frankfurt am Main on a site purchased by that city. One million dollars will be invested in the buildings and an additional half-million will be used for equipment.

Battelle is also establishing a research center at Garmisch, Bavaria, and has set up a program of laboratories for selected students in cooperation with Sweden and Germany. Dr. Fritz W. W. W. W. W.

Initial capital will be provided by Battelle. Operational funds are to be provided by European industries and governments and American industries in Europe. Most of the personnel will be European, with Americans used for administration and liaison. Labs will be staffed with European scientists and technicians.

RADIOGRAPHY MAKES SURE

this
jack base
can
shoulder
a big job



Hydraulic jack bases in use.

Hydraulic jacks are born to lift loads many times their own weight and size—to stand internal pressures of thousands of pounds per square inch.

These take sound castings—soundness which only radiography can prove without damage to the part. And the designers, knowing the casting will be sound, can count on strength without excessive weight.

Instances like this show why more and more

foundries are making radiography routine. It is the way to be sure only high-quality castings are released.

If you would like to know how radiography can improve your plant operation, talk it over with your x-ray dealer. And, if you wish, we'll send you a free copy of "Radiography As A Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, New York

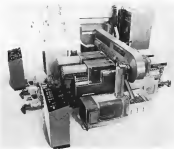
Radiography...

another important function of photography

Kodak
TRADE MARK



CHAMBERBURG IMPACTOR applies principle of complete absorption of energy when two equal, metallic masses collide head on at equal speeds. In the impact, the stress completely employs of the impactor's energy for deformation of the stock.



AUTOMATIC SET-UP for two impactors with positioning jet blades (figures are based on stock at upper left corner). 1, stock is fed to loading elevator. 2, loaded stock is checked for temperature (insulated piston actuated), 3, stock to transfer device for loading conveyor. 4, first impactor for rough forging. 5, second impactor for finish forging & forging finished from upper 7, discharge chute. 8, control for individual impactors. 9, control for complete process.

Parts Forged by Collision Hammer

By Irving Stone

A new type of hammer tool that forges metal in radius by impacting in the approach for forming metals that has been worked out by Chamberburg Engineering Co. Stock is fed through a series of dies that collide against the work, without rebound, to form the part.

The new tool is known as the Chamberburg Impactor and action can be seen in the air force experimental con-

clude first processing, longer life, decreased energy spent, improved metal working and lack of vibration.

While the company now stresses the tool's forging potential, other applications, such as extruding, are seen in the increased development of the process.

Already in Service—Two of the machines already are in operation, one in aircraft engine work at Thiessco Products, Inc., Cleveland. Since the Impactor cold-chamber die engine blades under an Air Force experimental con-

tact. This machine (A No. 6), delivering a 6,000-lb. blow strikes a magnetic hammer for positioning the blades.

The second machine (see A No. 6) is being used by International Silver Co. for cold-chamber extruding steel knife handles at a single blow with a production rate of 50 per minute.

►Packed With Use—Other machines are scheduled to go into operation before the end of the year.

Packard Motor Car Co. will soon get the first of four smaller units now being built for automatic precision-forging of blades for General Electric Co.'s H7 Chamberburg unit that production rates will be 4 to 6 times that of present methods, depending on use of the work. The Packard machines, each weighing two No. 6 impactors, will be tested with accuracy hoppers, feeds, conveyors, etc. Equipment will include automatic heating facilities (Olin Cast, shaft Co.), temperature controls (Leeds & Northrup Co.) and handling elements (Fiedell Co.).

Packard also has ordered its installers employing two 15,000-lb. impactors in the striking units to large turbine buckets.

►Other Customers—Two No. 6 units will go to General Motors Corp.'s Detroit division for repairing rough blades for the J67 Suprajet. The machine is now in its final test steps and will be completed at GM's facility with automatic heating and handling equipment built by Inland Heat Treating Corp. of Arizona. Production rates for this machine will be comparable to that of the Packard unit.



Under study for application at Curtiss-Wright Corp.'s Buffalo plant is another Impactor (No. 4 unit).

A machine with two No. 4 units is scheduled for Ultra Deep Forge & Tool Corp. Initially the metal finish will be fed manually while the development is tested out. An automatic heating cycle, engineered by Chamberburg, is planned for the machine.

►Theory of Action—Principle of Croco's new machine is simple. It is based on a law of physics that has been demonstrated in a classroom—when two metallic bodies of equal mass travel toward each other at the same speed and collide, both bodies come to rest with a complete absorption of energy.

The principle is mechanically transmitted to the machine by two opposing members—impeller—moving in a horizontal plane and curving dies at their extremities. Impeller actuation is by compressed air in opposed cylinder block, positioned in the impact plane, the two dies collide against the material, and the resulting deformation of the dies the impeller energy.

When two specimens are required, such as blocking and finishing, two impactors are installed, one after the

AN FLARED
FITTINGS

MS FLARELESS
FITTINGS

**BOTH TYPES, FLARED AND FLARELESS,
ARE PRECISION-MADE BY PARKER**

Consider your next order instead of parts . . . your rejection of faulty materials. Then you'll discover what other users have learned . . . that Parker is your best bet as the one reliable source for top-quality aircraft fittings!

Parker AN and MS fittings are precision-machined . . . under approved quality control manufacture . . . to meet the exacting specifications of government standards. You can depend on Parker, the original aircraft fitting manufacturer.

AN Fitting Catalog 701 and MS Fitting Catalog 4100A1 available from PARKER Aircraft Co. (subsidiary of The PARKER Application Company) 2827 West Century Blvd., Los Angeles 45, Calif.

YOU CAN GET
Parker
AIRCRAFT FITTINGS
IN
BONDED
STOCK



Parts sent to stores/inspected, quickly labeled and sent, easily identified by the permanent tags.

Parker

TUBE FITTINGS • VALVES • O-RINGS

Parks in Cleveland • Los Angeles • Dallas • Ohio • New York

INSUROK® AIRCRAFT PULLEYS

**to Government
Specifications**

**AN-210, AN-219, AN-220,
AN-221, and NAS Series**

Tough, lightweight INSUROK aircraft pulleys are precision made to meet rigid government standards. Richardson's production skill and years of experience give added assurance of top-quality dependability.



LAMINATED OR MACERATED
INSUROK pulleys are made from either laminated or macerated fabric. Both meet government specifications fully, although INSUROK macerated fabric pulleys cost slightly less.

SELF-EXTINGUISHING
Pulleys are available in fire-retardant materials. Even when ignited by direct flame, they retain an "after-glow" once the flame is withdrawn. This is an important safety feature in checking the spread of fire.

Write for Bulletin

The RICHARDSON COMPANY

FOUNDED 1928—CINCINNATI, OHIO

2784 Lake Street, Milford Park, Illinois (Chicago Office)

SALES OFFICES IN PRINCIPAL CITIES



STAINLESS STEEL jet blade is quickly processed as Inspector 1, exhaust-backed looping blank is suspended between dies for five blows. 2, blade looks like thin wire after and is ready to move to second Inspector unit. 3, final blow gives blade ready for drawing.

either for the successive steps. After each it would also be feasible to have blocking and finishing operations in a single set of dies, with the stock being fed for successive blows in the one Inspector, or in one die in the dual installation.

► **Advantages**—As a result of the almost complete elimination of energy in the lagging and the sagittal, there is no shock in retraction—rather in the machine, nor in the flow. Chamberlain says that the Inspector may be located directly in production lines, even if they are on upper floors, and adjacent to auxiliary or debris equipment.

Other advantages advanced for the process are:
► Material is worked equally from both

sides instead of from one face. This gives a more uniform working of the metal. In addition, metal travel is less, so that in lagging a sphere to a disk, 15% less energy is required than with a conventional hammer.

► Stock and die are in contact with each other and, in being done. This reduces the contact time to lower operating die temperatures, hence longer die life.

► Stock can be worked faster because of heat treatment involved. There is an appreciable increase in temperature of the stock, because energy of the impact is almost completely absorbed. This tends to obtain its process through

multiple strokes without re-heating, and lagging is at a lower metal heat.

► **Control**—Feeder—impeller movement is electronically controlled. Phase of impact is kept on center by an electronic comparison with rotating leads to detect blow oscillations. Rough adjustment of impeller blow intensity can be made by varying air pressure, while fine adjustment is by varying phase of valve openings. Both blow intensity and rate of blows can be varied, so that the operations such as the opening and automatic stock handling.

A blow will not strike if the stock is not properly positioned in the phase of control, and if it is possible to fit



SEWING HOT SEAMS THAT ADD MILES ... 8g PASTUSHIN!

Modern, precision methods used by Pastushin Aviation to produce aircraft components make possible lighter, stronger, gas-tight fuel tanks to increase range and combat effectiveness of America's fighting aircraft.

AIRCRAFT FUEL TANKS • SEATS • LANDING FLAPS
AIRBORNE • TANK SURFACES • BOMB BAY DOORS



PASTUSHIN AVIATION CORPORATION
2801 West Century Boulevard • Los Angeles 42, California
LOS ANGELES INTERNATIONAL AIRPORT LOS ANGELES, CALIFORNIA

Fastener Problem of the Month

VIBRATION-PROOF ELECTRIC TERMINALS

DECEMBER, 1952

PROBLEM: Severe vibration setting upon standard nuts used on electric terminals too frequently results in loose connections. Double nuts are difficult to adjust correctly and lock washers can tear with loose connections. Yet the increasing use of electrically powered components and increasing power loads make secure terminal fastenings imperative on modern civilian and commercial aircraft.



SOLUTION: Positive protection against the loosening effects of vibration is provided by self-locking brass Elastic Stop Nuts. The red elastic locking collar provides a consistent and positive grip on terminal studs... makes continuous performance more certain by preventing vibration or power supply failures. Because Elastic Stop Nuts lock in any position on the stud, whether they are seated or not, they are easily adjusted. They are readily removed and can be reused.



YOU may have a similar fastener problem—or a very different one. In any case, you'll find ESNA engineers ready and able to supply a solution. Mail our coupon now, for complete information.



Dept. N-6-1755
Elastic Stop Nut Corporation of America
3350 Woodloch Road, Union, N. J.

Please send me the following free technical information:

- ☐ Elastic Stop Nut facts
☐ How to design or use standard Wild fasteners (do you suggest?)
☐ AN ESNA Connection Chart

Name _____ Title _____
Firm _____
Street _____
City _____ State _____

the machine with a control to adjust work which is not at the proper test pressure.

It is practicable to enclose the arm and introduce an appropriate stem piece, if desired, since the forging is finished and stock is medium.

Five Research-Forge of economic power set in the machine is from its being to about 50% of that value, Chaudhury says. Ratings are by number representing maximum output in thousands of foot pounds per blow. Engineering work on mass forging from 4 to 400 in various increments already has been completed.

Research and development in the process is still being conducted to determine full potential. Investigation includes planar of die design, plastic flow and related subjects.

Supplementing Chaudhury's of data along this line a research project has been set up at Penn State's Engineering Experiment Station.

PRODUCTION BRIEFING

► Lindbergh Engineering Co., Chicago, maker of test test fixtures, has purchased 18 acres of land in Los Angeles for construction of a plant and office.

► Major Aircraft Corp., Monterey, Cal., has taken over additional space in adjoining buildings and opened manufacturing from detail parts production to speed output.

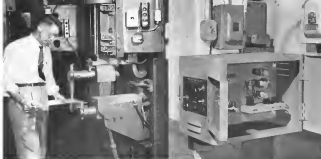
► Link Aviation, Inc., Binghamton, N. Y., has subcontracted part of its C-119 per flight hours contract to Werlitzer Co., Tarrytown, N. Y. The C-119A contract is being used to conduct pilot training in Korea.

► Northrup Aircraft, Inc., Hawthorne, Calif., has granted an exclusive license to Narco Research and Controls Co., Costa Mesa, Calif., to manufacture and market a metal-plastic adhesive for bonding Northrup airplanes.

► Saunders Associates, Inc., Torrington, N. Y., has commenced construction on a new plant in Vergennes, Vt., for precision manufacture of aircraft electronic and mechanical equipment.

► The University of Wichita, Wichita, Kan., has started construction of a new engineering building having 25,000-sq. ft. of floor space which is scheduled for completion in time for fall classes in 1953.

► North American Aviation, Inc., Los Angeles, has leased a new 134,000-sq. ft. building in East Los Angeles near



Laboratory Tests Prove Resistance Welding Aluminum Is Easier with . . .

NEW G-E UP-DOWN SLOPE CONTROL

WITHOUT SLOPE CONTROL



ELECTRODE FIDGUP is noticeable on this electrode, and 10 times without Slope Control.

WITH SLOPE CONTROL



LONGER ELECTRODE LIFE with G-E control. Above used on aluminum 1700 times—no dressing.



SEVERE BURNING caused by current surge in welding test specimen without Slope Control.



NO BURNING when G-E Slope Control automatically controls heat input in test welding aluminum.

HOW IT WORKS: This new G-E control increases heat input gradually (Up-Slope) to full heat, reducing tip pickup. After full heat rate has elapsed, heat is gradually decreased (Down-Slope), reducing porosity and cracking.

UNIFORM WELD STRENGTH is obtained only with G-E control because precision timing is used at point where Down-Slope starts.

For more information on the complete line of G-E resistance welding control, contact your nearest G-E representative or write: War Section 635 37 for bulletin GEC 902 and GEC-610 on Up-Down Slope Control.

Your resistance welding machine manufacturer or his agent will be glad to help you with resistance welding problems. General Electric Company, Schenectady, N. Y.



DUCTILE WELDS, such as this aluminum alloy (copper bent 17°), show no cracks because of the tapering effect of gradually decreasing heat input. This means fewer rejects.

RESISTANCE WELDING CONTROL

GENERAL  ELECTRIC

FOR

FASTER

SERVICE

GREATER VARIETY

HIGHER QUALITY

ALLMETAL
STAINLESS STEEL"AN"
BOLTS

AVAILABLE IMMEDIATELY FROM STOCK...an all-inclusive range of "AN" nuts. These bolts, made by America's foremost manufacturer of stainless steel fasteners, meet all the exacting requirements of "AN" specifications. To get the stainless steel bolts you want, when you want them, always specify Allmetal!

WRITE FOR
CATALOG,
ON YOUR
LETTERHEAD,
TODAY!

THE EMERGENCY ORDER!
Write Allmetal Screw Products Co.
1021, New York
or PHONE 934-4444

MANUFACTURED SINCE 1929

ALLMETAL
SCREW PRODUCTS COMPANY, INC.
33 GREENE STREET NEW YORK 13, N. Y.

ALLMETAL, NAME, AND DESIGN ARE REGISTERED TRADEMARKS

It, including 3,815 gal of fuel. This was within the allowable gross of 45,000 lb. It was impossible to locate a manual and all Phoenix's crew at which should have been sent to the company's headquarters in accordance with the Civil Air Regulations. At San Diego, 606 gal of fuel and 12 gal of oil were added. Using the basic weight out of Kansas City and estimating 150 gal per hour fuel consumption (usually used for C-47-type planning purposes) with 17 gal per stop allowed for towing and warm-up, the aircraft is calculated to have consumed Phoenix with a gross weight of 46,542 lb., including 715 gal of fuel at the time of the accident approximately 422 gal of fuel consumed.

Nearly all of the radio equipment was destroyed by the impact and subsequent fire. It was determined, however, that the 35.5 Central Band was positioned to Channel 11, corresponding to the Los Angeles 35.5 frequency, and that the ADF was tuned to approximately 208 kc. The Los Angeles 35.5 radio station operates on a frequency of 266 kc. According to company maintenance records, all radio equipment had been overhauled, establishing ZERO error time. It was then certified on this aircraft May 24, 1971. The ADF was actually overhauled Apr. 5, 1971.

All radio contacts with the flight were normal, the last one at 0755 being reported as, "over fuel and clear." The only anomaly mentioned by the flight crew was the difficulty with the ADF equipment because of rain. The Aeronautics Flight Inspection Branch of CAA on Apr. 15, made a visual check of the Los Angeles instrument landing system and the La Habra and Downey facilities. The report on this check indicated that operation of these facilities was normal in all aspects.

Investigation gives the crew at Phoenix several clues whether for the commander of the flight, with the exception of the time their vicinity of Los Angeles where Burbank was located to be returning with leg, and the Los Angeles Airport 3028 ft and 2 mi with leg and base at the time of the flight's attempted arrival there.

During the last leg of the flight, Phoenix to Los Angeles, it appears that there may have been conditions existed as far as Phoenix, Calif. At the time of the accident the weather at Los Angeles Airport was reported to have been ceiling 700 ft, overcast visibility 21 mi with haze and moderate turbulence 1 mi with fog. The engine and leg had been operating normal and at the time of the accident apparently included the views of Whittier and Phoenix, and the adjacent hills. The last of the storm report from about 1,200 to 1,500 ft and it is indicated that the west slopes of the Puente Hills, including the tops of all ridges and all of the crests, were in the fog at the time of the accident, however, it was clear considerably to the east of these hills. Aircraft using conditions of low cloud and turbulence, if any, would have been negligible.

On the morning of Apr. 15, shortly after 0700, a tower and base, flying at a speed approximately 160 ft above sea level and about 21 mi in a northeasterly direction from the scene of the accident, was distributed by a plane flying very low over the



HISTORY IN THE MAKING—When two big Sikorsky H-19s landed at Wiesbaden, Germany, on August 4, following a multi-stage flight across the Atlantic Ocean, a new chapter was added to aviation history.

To the Air Rescue Service, which conducted the flight this was an important proof of the ability of helicopters to operate in long-range missions. The test was made under severe weather conditions where the skill of pilots

and the performance of both of the aircraft were heavily taxed.

The successful completion of this historic flight was a major step in the evolution of the helicopter... already a craft of unparalleled usefulness and versatility. And it hastened the day when big helicopters of the future will be available to fly anywhere in the world, to perform their multitude of useful services.

SIKORSKY  AIRCRAFT

BRIDGEPORT, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION



SHELL AIR QUIZ

Question:

What non tropical flower owes its recent great sales to swift air transportation?

Answer:

Daily flights from Hawaii have now enabled low-cost orchids to be as accessible to American women as their neighborhood florist.



SHELL OIL COMPANY

30 WEST 30TH STREET, NEW YORK 10, N. Y.
100 RUSH STREET, SAN FRANCISCO 4, CALIFORNIA

Question:

Which Aviation fuel is the U. S. A. today likes the most for freight?
... the most passenger?
... the most for mail?

Answer:

SHELL AVIATION FUEL

lower. Getting out of bed, this one through a window the falling light of a low-flying airplane landed in a wondrous direction. The plane continued in this direction until out of sight but not out of hearing. Without even seeing the plane they heard it striking, landed nearby in a cloudy darkness it remained until beyond their range of hearing. No activity other than the way they reacted are known to have been in this area at that time.

Capt. Lewis Reed Powell had been in touch assigned as aviation for a number of years and had accumulated 7,741 hours of flying time, where he became personally acquainted on May 18, 1911, in a routine attack. This flight time included, in caption 1380 to 13 (DC-3), 1380 to 13 (C-4), and 680 to C-45. He was named Airline Transport Rating No. 64564 in Dec. 1945. This rating was awarded Dec. 15, 1951, after he had completed a rating and was a pilot check, in DC-3 aircraft given by a CAA assigned flight instructor.

The last attack occurred by Mr. Powell on May 18, 1911, way of such severity that his previous immediately over him to a hospital in an ambulance, under oxygen the condition improved sufficiently for him to be taken home by ambulance on Apr. 27 but he was confined to bed for an additional six weeks, following which activity was slow and gradually resumed. His assignment under medical order as an office pilot until December 1951, and was last seen by his physician on Apr. 12, 1952. His physician stated that he responded well to treatment and made an uneventful recovery.

On Sept. 3, 1951, Capt. Powell visited Dr. Francis C. Herring, the CAA-designated medical examiner from whom he usually took his pilot physical examinations. Although Dr. Herring found no physical large lesions in the examination when Capt. Powell in response to a question, stated that he had had a heart attack since his last CAA physical, the examiner told him he could not make a medical certificate in the state would require a diagnosis by the CAA Regional Medical Officer. Capt. Powell has been requested to appear in electromagnetic suit and a letter from his personal physician.



"In the company we call it 'The Iron Lung'—it's kept in place for the past 10 years."

The American

in forwarding to the CAA Regional Medical Officer.

Upon receipt of this information the Acting Regional Medical Officer, Dr. Paul M. Ellis, referred the case to the CAA Medical Standards Branch, Washington, D. C., and received the following reply, dated Oct. 25, 1951: "The case of Lewis Reed Powell, aged 45, shows definite evidence of posterior cerebral infarct and definite lesions. I believe that one of these cases should be cleared any claim of certification including Mr. Powell."

On Feb. 14, 1952, Dr. Herring in follow-up, on Nov. 15.

"This letter is intended to complete case record for Mr. Lewis Reed Powell. The John Smith in case Washington office left that Mr. Powell, like others

who have coronary artery disease, should not be certified for solo or pilot in cross country flight. I have given Mr. Powell a Class One certificate with the following limitation, 'Valid for Company Check Pilot Only.'

Mr. Powell has spent considerable time trying to come out of the no policy regarding coronary artery disease is under 18 and not considered.

I have suggested that he visit Dr. Smith in Washington for a cardiac test, I believe that he will do this.

I am sincerely sympathetic with Mr. Powell's occupational catastrophe; however, it is my conviction that coronary artery disease and pilot responsibility are inseparable. On Nov. 14, 1952, Captain Powell was

TESTED and PROVED

On the
Speedway

In the
Skyways

... take
advantage
of **ALL** the
STRENGTH
designed
in your
bolt!



**Klincher
LOCKNUT**

has no equal where
VIBRATION, TENSILE STRENGTH,
CORROSION, HIGH TEMPERATURE
are factors!

When greater torque is applied Klincher Locknuts will never rotate loose. Spent bolts drive to tight. On the corners of all of angles, use one and the application. Klincher has been tested, proved and acclaimed for three standard conditions:

- Reduces torsional load in bolt!
- Can be reused many times!
- Saves time, labor installing, removing!
- Only one piece to stock and handle!
- Ideal for standard and power wrenches!
- Manufactured in various materials!

STANDARD BOLT ELONGATION



Standard use in steel, stainless steel, aluminum, brass, copper, nickel, and other materials. See also: "The Iron Lung" and "The American".



KLINCHER LOCKNUT CORP. 1512 BELLEVUE AVE. INDIANAPOLIS, IND.

and saved a first-class medical certificate, dated Sept. 1, 1932, with the limitation, "Valid for Company Check Pilot Duties." When Capt. Powell was examined Mar. 14, 1932, for renewal of his medical certificate, Dr. Henry Brown found no physical irregularities but because of the pilot's brain had issued a medical certificate with the same limitation as before.

Mr. Powell, widow of Capt. Powell, was unable to testify at the medical investigation hearing. However, her statement was taken later at which time she stated that both she and Capt. Powell were well aware of the limitation on Capt. Powell's medical certificate, as was an officer at another airport where for whom Capt. Powell made two stops in Dec. 1931. She stated further that Capt. Powell told her he was

not desiring the limitation on his certificate with one of the other pilots, as he hoped to go to Washington and have the limitation removed.

Capt. Powell made application for assignment as a pilot with Robin Anthony on Dec. 23, 1931, and on Dec. 25 successfully passed an equipment and riding check as DC-1's second, given by C. A. Rutter, then Director of Operations for Robin Anthony and a CAA designated check pilot. Powell was listed by Robin Anthony on Feb. 26, 1932, and on Feb. 25 was given a pre-flight equipment check by C. A. Rutter as C-46 equipment. He was assigned as a pilot and made his first flight for the company on Feb. 24 between Oakland-Berkeley as a C-46. From the time he was employed by Robin through Mar. 31, Powell made

seven flights in C-46s, four in C-46s and five in DC-3s, four flights as co-pilot—one as a C-46 and three in DC-3s, and two flights as master pilot, both in DC-3s. On Apr. 1 he passed an equipment and riding check in the C-46, given by CAA Designee William H. Butler, with a below average grade of 75%, and on that date was so listed as a pilot by Robin Anthony. From Apr. 1 until Apr. 26, the date of the accident, Powell made nine flights as captain in C-46 equipment. With the exception of two trips between Berkeley and Oakland, all of his flights for Robin Anthony were between Berkeley and Kennesaw City. All of the passenger-carrying flights made by Powell were contrary to the limited medical certificate which restricted him to company check pilot duties.

Company officials testified that prior to the accident there was no review of the limitation on Capt. Powell's medical certificate although they had examined his pilot papers on more than one occasion. CAA Designee Butler, who gave Powell his C-46 equipment check on Apr. 1, testified that he, too, looked at Powell's pilot papers, including his medical certificate, and was aware of no medical limitations. He stated further that he was sure he would have noticed the statement under "limitations" he cases it would be so entered.

On Mar. 31, CAA Assistant Safety Agent C. O. Trapp was a stop check at Amador on a flight on which Powell was a crew member. He stated in his report that Powell did not possess the required income statement card. Mr. Trapp did not testify at the Board's medical investigation hearing that a statement was obtained from him, in which he stated that he examined Powell's medical certificate during the stop check and noted no limitations. This is inadmissible if the medical certificate was deleted when it was examined. It has been demonstrated that a medical certificate may be so deleted and placed in a container that while all other pertinent information may be easily read, that portion relating to limitations can be concealed. In addition, the specific wording of the limitation was such as not to indicate clearly and unambiguously the fact that it was intended to be a limitation on acting solely as a check pilot and as an officer, especially, but was at least an implied of the limitation that it appeared as additional information.

The writer states in Part 28 of the Civil Air Regulations is designed for use when a pilot's experience, ability, and judgment compensate for physical disability. However, in a number of instances, ability, and judgment are insufficient for an airplane which may, at any time, completely incapacitate the pilot. Hence the finding reported by Service 293 before a review is granted or not for a pilot's return to the air. Mr. Butler testified reported the Administration of Civil Aeronautics to the specific steps to prevent recurrence of such a situation as arose in the case of Capt. Powell.

According to testimony of Dr. Ellis, the rating CAA medical officer at Dayton VI, the intent of the limitation placed on the medical certificate was to restrict Powell to company check pilot duties only and he was not to fly solo as a pilot as command, or as a copilot. Capt. Powell was fully aware of



WORLD'S SPARK PLUG CAPITAL HOSTS AVIATION'S IGNITION EXPERTS

Every year, the Champion Spark Plug Company invites the best informed men in the aviation world to Toledo for a three-day conference on spark plugs and ignition problems and their solutions. This year, 144 experts came from the four corners of the earth to attend.

This striking thing about these Champion meetings is that, while most of these men are in vigorous competition with each other 365

days a year, they meet here on common ground, believing that by helping each other, they can make flying safer and better for all. Much good for aviation has resulted.

Dependable spark plug and ignition performance is, of course, a prime requisite of all aircraft engines. We are proud to point to the singular achievement of having Champion Spark Plugs in use on every domestic trunk airline today!



CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

CHAMPION

IS A MAJOR SUPPLIER TO THE
U. S. AIR SERVICES

The R109 and R107-1 are the most widely used of Champion's three types of aircraft spark plugs.

Reliable braking at the touch of a finger with Westinghouse Air Brake Valves



- Smooth, precise control
- For both normal and emergency braking

A pilot has precise, effective braking at his finger tips if his plane is equipped with Westinghouse Air Brake Valves. For he carries a lever on his control panel by one get any desired braking rate—the brake responds instantly to each small movement. And for each lever program the control system automatically maintains a constant braking force.

Two high-speed pressure-generating valves operate the air pressure applied to the brake cylinders. These valves (at complete mechanical) devices that insure reliable brake operation. They are easy to service and require very little maintenance.

Progressive braking can be used on any type of plane, for both normal and emergency braking.

It will pay you to investigate the advantages of having these pneumatic devices on your plane. Our engineers will be glad to talk to you about it—write to Westinghouse Air Brake Company, Industrial Products Division, Newark Section, Newark, N. J.

AIRCRAFT
SECTION

WESTINGHOUSE

AN ELECTRIC COMPANY, PITTSBURGH, PA.

INDUSTRIAL PRODUCTS DIVISION



Cooling and Ventilation



**Motivating Cams, Timing Devices, Antennas,
Clutches, Optical Equipment, etc.**



Each induction and synchronous motor can be supplied for either motor or generator duty, with standard or high temperature insulation. Drive and synchronous motors may provide shaft



CONTRIBUTOR BIOGRAPHY

400 spins, 80 spins: no noticeable frequency
range 1300 to 1600 cm⁻¹

Automatically fire sensors upon each frequency change in various frequency models with continuous waveforms.

[illegible]

LEGAL FLOW PAGE

400 cycle operations

recovery time—no cycle repeats

Generates a Q scale pressure by ambient temperature from -40° to +85° C. Made in 1, 2, 3, 4 and 104" bar diameters. Only weight 10 to 200 gms

...and the ...

off-axis 40-μm single and poly films, 1
on 1 pole. From diameters: 1.00", 1.50",
2.00", 2.50" & 3.00". Output range
10 to 1000 on 10 to 100

5784 • J. Neurosci., September 24, 2008 • 28(39):5779–5788

[illegible]

the intent of this medical institution. Dr. Ellis testified that Powell spent several hours with him at the time the medical certificate was issued, discussing the significance of the institution and trying to persuade him to issue the certificate without it. The record also shows that Dr. Frank Allen, then Chief, Safety Operations Division, CAA Region VI, also knew of the institution, and that he had discussed it with both Capt. Powell and Dr. Ellis.

This autopsy suggests reported by forensic evidence that Capt. Fursell had a badly damaged heart and that he had had a recent hemorrhage. While he could not determine whether or not death had occurred before the crash, he did state that this hemorrhage had occurred within "probably a matter of hours of the outside. It could have been immediately before or it could have been a matter of several hours before."

Edison Aulanti ground training program for pilots is handled under contract by Foster Aeronautical Service at Buffalo. A description of that training program was given in this Board's report dated July 16, 1952, covering the forced landing involving this crash at Colbony, Canada, Dec. 28, 1950.

During the period of approximately two months that Powell was in the hospital, Rubin Aronson, his cousin and completed two of Furber's summer medical internships with a grade of 100%, the other with 94%. In addition, he had enrolled him of Link instruction in March, which was discontinued because of mechanical difficulty with the equipment.

Company records indicated that Copied Williams was sent one of these sensors early, and several days after starting working for Radar Airlines on Apr. 1, however, there was nothing to indicate that he had either received or completed it. On Apr. 1, Mid-Data was given a pre-assembly instrument and equipment check flight in a C-46 by CNA Delmonte Earles after which time he was assigned by Radar Airlines as a copilot.

Since examination of the wreckage and review of maintenance records did not reveal any evidence of failure or malfunctioning of the aircraft or power plants or of any of their components prior to the crash, and since no mechanical difficulty was reported in any of the radio contacts with the flight, it must be concluded that the cause of the accident was operational rather than mechanical.

Based on the losses had shown when the flight departed Kansas City and that taken aboard at Phoenix, it is evident that there was sufficient fuel for the flight to have remained in the air from two to three hours, long as the crew considered it necessary or advisable. It is also apparent that it is not in accord with the ground the aircraft was in controlled flight with both engines operating at approximately 1,000 r.p.m.

The aircraft had single radio equipment and all contacts, the list of which was partly few seconds before the crash, were reported to have been "loud and clear." It could not be determined whether these contacts were made by the captain or the flight instructor. Moreover, nothing was said or otherwise noted to indicate that the flight was in progress.



ORIGINAL DESIGN of jet oil cooler pioneered by Clifford

ADVANCED DESIGN

Obvious Simplicity
Elimination of Gaskets, Bolts and Nuts
Weight Saving of 28%
High Pressure Rating
Greater Ease of Servicing



Again . . . Clifford Oil Cooler
engineering keeps pace with turbojet progress

Engineering achievements like the one shown above are made possible by Calsonic's unique patented braking method and laboratory facilities—the largest and most modern in the international heat exchanger industry.

For information on Clifford oil coolers write: Clifford Manufacturing Company, 128 Grove St., Woburn 24, Massachusetts, Division of Standard Transformer Corporation. Sales Offices in New York, Detroit, Chicago, Los Angeles, Wichita, Massachusetts.



ELFORD HEAT EXCHANGER
— CUSTOM ENGINEERED
FOR MAXIMUM EFFICIENT HEAT TRANSFER

40% of the Aircraft Oils used by major airlines in the U.S. is supplied by SINCLAIR...

Supplying approximately 40% of the aircraft engine oils used by the large commercial airlines within the United States is a big order — but it's no order Sinclair fills, and points to, with pride. Over the past 17 years, Sinclair aircraft oils have flown millions of miles in the engines of many airplanes, providing vitally important protection against friction and heat. Why not entrust your vital lubrication needs to Sinclair aircraft engine oils?



SINCLAIR REFINING COMPANY, AVIATION SALES, 600 FIFTH AVENUE, NEW YORK 20, N. Y.

These J-M Goetze Gaskets guard against fire hazard and power loss...



Arrows point to J-M Goetze gaskets on the inner and outer casings, and their approximate location on the J35 turbojet engine section frame.

...on powerful turbojet engines like the J33

Sealing the inner and outer casings on the J33 to prevent leakage of fuel and flame into the engine is another example of the many tough, critical sealing jobs reserved to Goetze custom-crafted metallic gaskets.

For this particular service condition, the Goetze gasket specified is made from a flat gasket design—with the rounded lead edges reinforced as a sealant filler. This construction provides the resilience needed to overcome the warpage encountered in these applications. Like all Goetze gaskets, this style is precision-made to fit tight and stay tight in service.

There is a Johns-Manville Goetze gasket for practically every jet en-

gine requirement. Goetze engineers can fabricate them almost any shape or size for sealing turbines, compressor bleed-offs, cross section tubes, combustion chambers, fuel nozzles, turbine drain lines, etc. Backed by more than 60 years of Goetze "know-how," these durable gaskets are solving many of industry's most complex sealing problems.

Why not write for further information about Johns-Manville Goetze gaskets...and order J-M flight proved products for the aviation industry. Ask for your copy of Brochure A-V-1A. Address: Johns-Manville, Division, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.



Crossing of J-M Goetze metallic gaskets used as inner and outer sealant gaskets on jet engine turbine frame.

orce of the accident was clear. Much of Captain Powell's flying experience had been acquired as the Los Angeles area and he was familiar with the terrain. Only 3 mi. south of the scene of the accident, the terrain is considerably lower, and had the aircraft been in this area, a visual approach might have succeeded. There is no reason for such an approach to have been attempted, however, as none of the presumed capabilities of the crew and the properly functioning flight and ground facilities available to the IL5 approach for which the flight had been cleared.

On Mar. 25, 1953, the Administrator filed a complaint with the Board regarding revocation of the singular on under operating certificate held by Robert Arneson, Inc. On Apr. 16, 1953, after the subject accident, the Administrator suspended its corporate suspension on that certificate and on June 27, 1953, the Board continued the emergency suspension pending final decision in the revocation proceeding.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier was operating under Air Carrier Operating Certificate No. 6 272, issued by the Civil Aeronautics Administration on Dec. 18, 1951, to Robert Arneson, Inc.

2. The aircraft was properly certificated, as a generally standard and loaded within its certified gross weight; it carried ample fuel for continued flight at the time of the accident.

3. Capt. Lewis B. Powell acted as command pilot on this flight and on previous ones, contrary to the limitation imposed by his medical certificate, although he was fully aware that this limitation restricted his flying activities to company check pilot duties only.

4. Captain Charles K. Weldon was properly certificated for the flight involved, but during this flight exceeded the flight time limitations prescribed under Section 41.45 of the Civil Air Regulations.

5. The flight was not conducted in accordance with the AIREC approach clearance, so that it descended considerably lower than the minimum altitude prescribed between Milwaukee airport and Downey air tower.

6. The flight was in clear weather with nothing the Purdy 100, which was close on the east side but in fog to the west.

7. Weather conditions at Los Angeles International Airport were satisfactory for the IL5 approach for which the flight had been cleared, but was not satisfactory for a visual approach.

REMARKS OF BOARD

The Board determines that the probable cause of the accident was the action of the pilot in descending below the minimum altitude for which he was cleared, and attempting an approach at an altitude too low to clear the terrain.

BY THE BOARD

BY DONALD W. STEPHENSON
BY DONALD W. STEPHENSON
BY JOHN LEE

Joseph F. Adams, Member, did not participate in the adoption of this report.

MYSTIK BRAND TAPES

• SELF-STIK

Medal for Men in Industry

for cutting production "red tape" with Mystik® Brand Tapes.

For coverage in the face of ever-increasing costs... for increasing speeds... for new labor-saving processes... for the maximum light against the ever-growing black-over-paint... we present the citation to the Men in Industry.

The key men in industry today are the men who can find ways to keep production up and costs down. More and more of these key men are finding in the full line of Mystik® Brand Tapes, new methods that eliminate costly operations and overheads.

Let us send an experimental sample roll of Mystik® Brand Tape to the key men at your organization who are interested in saving costs. Write Mystik, Adhesive Products, 3043 North Halsted Avenue, Chicago 38.



Johns-Manville PRODUCTS for the AVIATION INDUSTRY

Sellable Waterproof Cloth Tapes • T.E. tapes • New Mystik® Tapes • Masking Tapes • Unbreakable Cloth Tapes • Alpha® Protective Wraps • Alpha® Spray Mask • Alpha® Seal Mask • Alpha® Del-Pipe® Insulation • Alpha® Shatter Tapes • Alpha® Rock Barrier Tapes

©1953 Johns-Manville Products

Circle 10 on Reader Service

When Space is at a Premium and
Performance is Essential...

THESE RESISTORS DO THE TRICK!

Engineered for small space and big requirements! Take a look at 8 page flyer containing charts, tables, notes for reliability engineers. All were developed by IRC to fit specific needs. Many meet JAN or MIL requirements. And all are available on short delivery cycles.

Smallest Fixed-Composition Resistor in the World

Type RFR-75 will double JAN R-75 size dimensions, dissipated power capability, and stability. Nearly two times as stable as JAN R-75. In operation, RFR-75 will double the life of R-75. In operation, RFR-75 will double the life of R-75. In operation, RFR-75 will double the life of R-75.

Small, Dissipated-Coupled PRECISTOR

Type DCC-101, 1 and 2 watts—Can meet military and aerospace with high stability and excellent resistance to temperature and radiation. Resistance drifts less than 5% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, DCC-101 will double the life of DCC-101.

New Boron-Carbon PRECISTOR— Ultimate in Stable Resistor-Wire Wounds

Type BCC-100—Boron-Carbon PRECISTOR meets the most exacting stability requirements in all environments of MIL-STD-883C. Voltage coefficient less than 20 ppm per volt per year. Load life coefficient less than 100 ppm per year. Resistance drift less than 25% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, BCC-100 will double the life of BCC-100.

Most Reliable and Stable of All Precision Wire Wounds

Type WCC-100—Wire Wound PRECISTOR meets the most exacting stability requirements in all environments of MIL-STD-883C. Voltage coefficient less than 20 ppm per volt per year. Load life coefficient less than 100 ppm per year. Resistance drift less than 25% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, WCC-100 will double the life of WCC-100.

High Ohmic, High Voltage Resistor with Axial Leads

Type HVR-101—High Ohmic, High Voltage Resistor with Axial Leads. Resistance drifts less than 5% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, HVR-101 will double the life of HVR-101.

Miniature Grids for High Frequency Applications

Type GMR-101—Miniature Grids for High Frequency Applications. Resistance drifts less than 5% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, GMR-101 will double the life of GMR-101.

For High Voltage Surge-Protection Surge or Control

Type HVR-101—High Ohmic, High Voltage Resistor with Axial Leads. Resistance drifts less than 5% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, HVR-101 will double the life of HVR-101.

Flat Insulated Wire Wound— Most Adaptable Ever

Type FWR-101—Flat Insulated Wire Wound Resistor. Resistance drifts less than 5% at 100° Centigrade for 1000 hours. Excellent resistance to moisture and other environmental factors. In operation, FWR-101 will double the life of FWR-101.

AVIONICS



ERCO RADAR is operated by British technicians who will accompany suit to U. S.

ANDB to Try 'Poor Man's GCA'

British device may answer need for copter landing aid; uses single antenna radar with radio DE.

By Philip Kline

The Air Navigation Development Board will take delivery this month of a new low-cost British ground-controlled approach radar to evaluate its contribution as an instrument landing device for helicopters.

The British GCA can be mounted in a small trailer and is designed to permit the direction of its "look-around" and the angle of its "slide-scope" approach paths to be quickly changed. This feature makes the device particularly attractive for military helicopters operating close to the front lines in combat areas.

After, Messer Corp., Coast Guard and civilian helicopter operators are expected to follow the ANDB tests closely because of the pressing need for helicopter instrument landing aids. One example of the need the starter date for the recently inaugurated airport-to-airport helicopter aid service in the New York area had to be delayed because of weather.

►Poor Man's GCA—ANDB has purchased for \$15,000 one of four prototype equipments built by E. K. Cole Ltd. of England. This figure includes spare parts and the services of a British technician who will accompany the

equipment. Previous approach radar (PAR) now in use at major U. S. airports cost over \$100,000 unmodified. The equipment with the Cole equipment is popularly called "poor man's GCA."

The Cole GCA was originally designed for use at low-density airports. Although ANDB hasn't yet determined a test site for the new radar, selection of a Messer or Army base seems likely because of Messer radar interest in the problem.

►Low Complexity, More Work—E. K. Cole has been able to push out and compress in extremely confining a single-antenna radar with a VHF radio direction finder. This eliminates the two radar antennas used in PAR and one radar control complex. For example, the ERCO radar can fit in a 10' x 10' room. The permit, however, is that the ERCO device places a heavier work load on the GCA operator.

The direction finder antenna and radar antenna are mounted on a common vertical shaft and oriented so that the center of the radar beam (or azimuth) corresponds to the null position of the DF antenna. When the direction finder is aligned on an approaching aircraft, the aircraft will also be centered

approximately in azimuth in the radar beam. This is the technique used to initially "acquire" the approaching aircraft, or helicopter, in azimuth.

To maintain the acquisition, the operator then constantly turns the radar system in elevation until he gets a continuous signal return (echo) on his radar scope. Once this is done, the approaching aircraft is centered both in azimuth and elevation in the radar beam.

►Scope Presentation—The ERCO set gives the operator an Azimuth type of radar presentation. The target appears as a small vertical "spoke" whose horizontal (X-axis) displacement from the left is determined by the target's distance from the antenna. A scale along the radar scope enables the operator to convert this X-axis displacement into distance in miles.

Because the Azimuth doesn't show the plane's azimuth or elevation position (as in PAR scope), another means must be provided to give the operator the needed left-to-right information.

►Indicating Lights—As long as the approaching plane is centered in the radar beam, the azimuth and elevation position of the radar antenna itself is an indication of the airplane's azimuth and elevation position relative to the antenna, and so the indicator for the runway.

Four electric indicators (two for azimuth antenna position and two for elevation antenna position) operate as flashing lights adjusting the radar scope to show whether the plane is on the proper approach path.

If the indicator, and hence the radar antenna, shows the selected approach path, the "D" down" switch will be actuated and its indicating light will be at "The Up and 'N' Right" lights are switched manually. If the plane is on the correct path, all lights are dark. The GCA system uses six indicating lights, and retains the indicator for the pilot's visual observation of VHF communications range.

The four switches can be released relatively easily as it is desired to shift the approach direction or glide slope angle.

►Keeping Direction—As the aircraft's azimuth or elevation position changes, the operator must reposition his radar antenna using the manual controls provided. ERCO has incorporated with foot pedals, handwheels, and bicycle grip type controls. The operator must continuously adjust the antenna position in both azimuth and elevation to obtain the greatest return signal as evidenced by an increase in height on the radar scope. A PAR operator on the other hand, is not bothered with these duties.

ANDB wants to find out whether these additional duties require a major handicap on the GCA operator. During



INTERNATIONAL RESISTANCE CO. LTD.

Dept. P, 401 N. Broad Street, Philadelphia 9, Pa.
In Canada — International Resistance Co., Ltd., Toronto, License



on job after job...
*YOU'LL FIND

Snap-on BOXOCKETS

the handiest, safest, fastest
wrenches you have ever used

Do your job on the job... with Snap-on Boxsockets.
For stronger and more secure take down
open end or adjustable wrenches! Open
ends provide simple clearance in tight places.
Double boxsocket openings completely en-
circle the nut—grip securely on all six
sides—prevent slip—prevent spread—
require only half the turning space where
access is limited. Each Boxsocket pro-
vides two wrench teeth on each head.
Caseless steel covers full range of
sizes, 3/8" to 1 1/2". Other types—
Alu-grip, Diesel, Heavy Duty and
Snap-on's "I" to 5 1/2". Write for In-
formation Catalog and General Cat-
alog of 4,000 Snap-on tools for pro-
duction and maintenance.

3/8" to 5 1/2" OPEN END BOX SOCKETS—
1/2" to 5 1/2" OPEN END BOX SOCKETS—
1/2" to 5 1/2" OPEN END BOX SOCKETS—
1/2" to 5 1/2" OPEN END BOX SOCKETS—



SNAP-ON TOOLS CORPORATION
P.O. Box 1, 350 Ave. • Kenosha, Wisconsin
Representatives of Snap-on Tools Corporation



PROTOTYPE EKCX and drive roller, DF,
shown in operation.



FOOT PERMANENT and wheel, EKCX
shown in operation.

a demonstration for ANDR. This machine
is built for a new type of tool, only the
EKCX roller after a short period of in-
struction and didn't seem overly bur-
dened by the device, according to an
ANDR operator who saw the demon-
stration.

Another potential shortcoming of the
EKCX equipment is that the indicating
lights don't give the operator or the
pilot an indication of how far the ap-
proach is off the desired approach path.
The pilot only knows that he is "on"
or "off." He doesn't know how much
correction is necessary to get back on
the correct path.

Whose PMA permit the small-
tension ball-down of several aircraft,
the British equipment can handle only
one airplane at a time, because the



tight quarters are no problem

Torrington Needle Bearings have smaller OD in
relation to rated rated load capacity than any other
type of roller-bearing.

In many products, compact Needle Bearings offer
reduction in size and weight of bearings and related
assemblies. In others, they permit the use of larger,
stronger shafts without increasing housing sizes.

Whatever your space problems, it will pay you to
investigate the combination of high capacity and
small OD offered by Torrington Needle Bearings.
Our engineers will be glad to assist you.

THE TORRINGTON COMPANY
Torrington, Conn.
Sole U.S. Office and Distributors in Foreign
Countries of United States and Canada



TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

of **ALL** the world's

International Airlines*



AVIATION PRODUCTS

The ES90 winged eagle, symbol of leadership in aviation petroleum service, is backed by more than 45 years of aviation experience including many pioneering achievements.

It was an ES90 refinery that supplied the gasoline for Neville Wight's historic flight at Kitty Hawk. North Carolina on December 17, 1903. Three decades, ES90 Aviation Products have played an ever-increasing part in the advancement of aviation.

In 1944, the first aviation engine test unit, specifically designed to test fuels and lubricants in full-scale aircraft engines, was inaugurated at the ES90 refinery in Baytown, Texas. Meeting the changing requirements of modern air trans-

portation, ES90 marketers were also the first to develop and expand the use of the Helicon Rotating System. Today, even at such widely separated airports as Gander (Canada) and New Orleans (Louisiana), the ES90 winged eagle guarantees safe, dependable petroleum service to all aircraft.

Around the clock, around the world ES90 Aviation Products are available where you want them, when you want them.



*Available in U.S.A. & U.S. possessions only. Not available in some restricted territories.



Kickout—The EKED GCA is a low power (10-hp, 1.5-ton) roller. Length and elevation limits within 1/2 day between half-power points. Present PARs have a peak power of 15-40 hp, an elevation limit of about 9 ft day, and an elevation limit within 1/2 day.

With its broader beam and lower power the EKED GCA could not be expected to give control as precise as PAR over under optimum conditions. The EKED range has two magnitudes 0.1 miles and 0.15 miles.

Bernard Collins, manager of the Southend (England) Airport at which the EKED equipment was installed, notes that 1,600 GCA approaches will accompany the set to the U.S.



Slidewire Pot

A new key slidewire potentiometer capable of rotation through 1,600 deg (90 revolutions) and with unlimited (and accurately) resolution has been announced by G. M. Cassani & Co. Called the "Spindlet," the device is available in five standard resistance values between 500 and 2,500 ohms for use in computer or servo systems. Cassani says the pot has "exceptional linearity," will meet operating specs under 50G accelerations, and functions at temperatures of -55C to 75C. The device weighs 4 oz. and is said to be capable of withstanding a million rotations at 200 rpm.

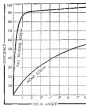
G. M. Cassani & Co., Inc., Pasadena, Calif.

Static Converter

A new static converter for subzero use can supply up to 400 amp of 500-volt power from a 115V, 600-cycle source, its maker, Mercury Electronic Co., announces. Weighing 31 lb., the converter is designed to hold output voltage constant within one-third of no-load from zero to full load and for input voltage fluctuations of 105 to 115 v. Mercury says "The unit will operate from -65 to 55C and its material and workmanship meet AN-6-37, according to the maker. Box 450, Red Bank, N. J."

SAGINAW BALL BEARING SCREW JACK UP TO 97% EFFICIENT

IN CONVERSION OF ROTARY TO LINEAR MOTION



The Saginaw Ball Bearing Screw and Nut is the most efficient known method of converting rotary into linear motion. Almost friction-free, this device—of far greater efficiency than the Acme screw—is widely used in aircraft actuators.

The Saginaw Ball Bearing Screw and Nut offers many superior advantages. Lower power to drive the screw; lighter, higher speed in both directions, with less friction and heat convection; and a minimum of maintenance.

Each Application Specially Designed
This specific miniature apparatus will under extreme loads and/or speeds in a wide range of aircraft applications. It is limited only by the power available. Because each application is a special problem, each individual screw is designed to meet that problem.

Many-Phase Adequate Production Facilities
Saginaw Steering Gear Division has the machinery, skilled craftsmen, and complete inspection and engineering departments to produce in whatever quantities and at whatever speed your schedule calls for.



Extensive manufacturing facilities, plus many years of experience, make possible the outstanding high quality for which Saginaw Steering Gear products are famous.



Engineering facilities are complete. Engineers are available. The facilities can design a ball bearing screw to meet your specific requirements.



- REASON:**
- Easy specification/standard, SAE
 - Compact design
 - Low Power Requirement
 - Light Weight
 - Low Maintenance
 - Wide Variety of Applications

Saginaw

General Motors Corporation, Indiana, Michigan

ES90 PRODUCTS

STEERING GEAR ASSEMBLIES
STEERING LINKAGE ASSEMBLIES
PUMP/VALVE SHAFES • MISCELLANEOUS AND SPECIAL PARTS

**INSTANT
AUTOMATIC
FLOW
and
FRET-OFF**

**WHY
Genuine
HANSEN
COUPLINGS
HAVE BETTER SERVICE
LAST LONGER**

**QUICK
CONNECTION
and
DISCONNECTION**

**Look-Proof
Minimum Wear
Looking Better**

Looking just as clean
Push-Pull Coupling Index
afford longer wear
coupled with no
thrust opposing
wear and extra
quick linkage

**PICK GENUINE HANSEN COUPLINGS
FOR HANSEN PERFORMANCE...**

• To connect a Hansen coupling, you merely
push the plug into the socket with one hand.
Flow is instantaneous. To disconnect, push back
slide on socket—coupling disengages. Flow is
shut off instantly and automatically.

Write for catalog giving complete range of types and sizes

**Integral
Tether Attached
Tether Head
Socket Head**



SALES REPRESENTATIVES


WEST COAST: HANSEN COUPLING CO., INC.
EAST COAST: HANSEN COUPLING CO., INC.

SALES REPRESENTATIVES

ALBANY: ALBANY ENGINEERING CO.
ALBANY: ALBANY ENGINEERING CO.


SALES REPRESENTATIVES

ALBANY: ALBANY ENGINEERING CO.
ALBANY: ALBANY ENGINEERING CO.



KNOW HOW

Modern warfare demands top flight engineering and scientific KNOW HOW. This is why the U.S. Military Services have entrusted some of their most perplexing and top secret projects to Coleman Engineering Co. Now in its third year, Coleman remains in its perennial status of the best known scientific and engineering basis in the field. Coleman may not know the answer to your engineering problem, but does know how to go about finding the answer.



6040 W. JEFFERSON BLVD., LOS ANGELES 16, CALIF.

**30000
FILTER CENTER
88000**

► **Transistor Tetrodes**—By adding an extra element to the conventional three element junction-type transistor, Bell Laboratories has upped the transistor's operating frequency by a factor of 10. The new, four-stage tetrodes have been operated at sine wave oscillators at frequencies higher than 150 mc., E. G. Schupert of Bell Labs recently told an IRE audience in New York. The fourth element is connected to the tetrode base opposite the emitting base element and is negatively biased to create a current to flow between the two base elements. This base current lowers the base resistance, cutting electron transit time, and then increasing the mobile frequency range.

► **GE Gets F-86D For Tests**—USAF has leased General Electric's North American F-86D interceptor for flight tests at Edwards AFB, Calif. It will be for "authentic development" of GE's turbojet engine control system that goes with the plane's J47 GE-17 engine.

► **Battus Tests Spray JLS-Spray's** earliest ramjet engine (2,600 hp) is currently under test in England with results to date reported as very favorable. Later version which operates at 5,000 hp has been evaluated by USAF's AF Weather Flying Division, but final report has not been made public.

► **Northern Pacific Atomic Lab**—For them Mfg. Co. will build a new 50-million laboratory for atomic and radio work on the edge of Hanford Airfield in Richland, Wyo. Lab will have 25 specially designed test bays for operating and checking Navy radio equipment.

► **Landed With Atomics**—A new Royal Air Force airplane, unidentified as to type, will have 25 different radio and radar sets on board according to a recent announcement. The Air Ministry is reported to be spending some on atomic equipment before then it did on aircraft prior to World War II.

► **New Toolmaker Builders**—

- Regulated Voltage Supplies for the laboratory, available in 16 different models with a variety of output voltages ranging from 3 to 1,200 v are described in new condensed brochure available from Kappa Laboratories, Inc. (151-16 Bedford Ave., Flushing 65, N. Y.)
- Ceramic disc capacitors now available in 40 different types instead of the current 15, are described in the new 1962-63 Acron Catalog. Units are available in single two or three section types. (New Bedford Mass.) —FK



More Tapered Sheet on the way

By late 1955, wider and longer tapered sheet and plate will be rolling off the mills.

new mill at Alcoa's Downport, Iowa, Works

leased from the U. S. Air Force, the new mill will produce widths up to 10 feet and lengths up to 35 feet.

That Alcoa continues its expansion to supply the requirements of our growing aviation industry.



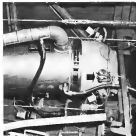
Aircraft and Parts Manufacturers.

should know Alcoa. How to buy Alcoa. Write and request copies to: Alcoa Sales Corporation. Ask for copy of the following brochure: *Providing Alcoa Aluminum, Engineering for Alcoa Our Chicago Designing for Alcoa Designing, Alcoa's Aluminum and Its Alloys. Send Also our available on and literature program.*

ALUMINUM COMPANY OF AMERICA, 1000 N. 4th St., Pittsburgh 16, Pa.



FENWAL'S VERSATILE HUP HELICOPTER, here shown hovering on support from the sea, serves a number of purposes for the Naval Fleet. Used for anti-submarine patrol training, it also proves invaluable for personnel recovery training. It is required to operate under severe climatic conditions. Automatic heat control of the HUP's insulated, steel-probed cabin is maintained by Fenwal THERMOSWITCH units.



FENWAL THERMOSWITCH units are installed on the HUP's heater heater, shown here. These units help make possible constant, comfortable cabin temperatures for crew and passengers. Shown above their use in aircraft, Fenwal units are also used in many control devices in many aircraft applications.



THE THERMOSWITCH unit equipment, shown, maintains the suitable conditions found in helicopters. The unit shown, on Fenwal Type and Overhead terminals, is installed in all types of Fenwal Aircraft Controls and systems vibration proof performance of all Fenwal electronic products.



ENCLOSURE ELECTRICAL CONTACTS of a Fenwal THERMOSWITCH unit are seen in this wiring view. The temperature-sensitive steel capsule or detector responds instantly with temperature changes, then makes its linking the contacts. Fenwal units are compact, highly resistant to shock, vibration, and corrosion and extreme temperature conditions. For complete data on them and other Fenwal Aircraft Controls, write FENWAL INCORPORATED, 2035 Pleasant Street, Bedford, Mass.

THERMOSWITCH®

Electronic Temperature Control and Detector Devices

SENSITIVE...but easy to heat

Fenwal

EQUIPMENT



BEFORE Separator before air filter separator when the gas valve is opened, taking separator out of the cabin.



AFTER With the Stratos separator out into the left wing. TPO of the machine is removed and stored into the jet.

Separator Spins Water Out of B-47 Air

Stratos centrifugal unit, developed for Boeing, is designed to keep cabins fog-free in fast descents.

By George L. Christian

A centrifugal air machine separator, first to be used in aircraft, is being used attached by Stratos division of Fenwal Electric & Aircraft Corp. for Boeing Airplane Co.'s B-47 bomber.

Development of the machine, conceived by S. E. Walker of Boeing, was begun as a pass research project at Boeing, then the work article was available on the market. Later the company asked Stratos to construct refinements and to produce the machine.

► **High Efficiency**—Stratos engineers, who produced the machine at Boeing's request, are proud of its average efficiency of 75% water removal (actual efficiency of 55% has been obtained). They say their efficiency is remarkably good in view of the weight, space and pressure drop restrictions imposed on the design.

Have no Stratos' space for the M5601 separator capable of handling 60 lb./min. of air; weight, 55 lb.; length, 20 in.; maximum diameter, 7.5 in.; inlet and outlet area, 4 sq. percent; drop, approximately 44 in. Hg.

► **No Dry Air**—See-Vis air machine separator is almost a vent in ordinary jet aircraft. When a B-47 makes a rapid descent from high altitude where it has been chilled, the high moisture content at lower levels may suddenly condense and fog up the cockpit. Condensation on the windshield obscures view outside the cockpit.

In some cases, pilots have reported fog so thick as the cockpit they couldn't read the instruments and were unable to tell the plane's attitude, altitude or air speed. Danger of such conditions is great, it is especially critical at low altitudes where aircraft is coming in for a landing.

Another very real problem, when air enters the cockpit suddenly speeds fog, pilots may mistake the machine for smoke. Oxygen masks, standard equipment on jet aircraft, prevent pilots from smelling difference between smoke and fog. In at least one instance a jet fighter pilot rolled to the floor that he was having trouble because his ship was on fire. Later it was ascertained that what he meant was that his fog, not smoke. The incident occurred at 300 ft., and both pilot and plane were lost.

The machine also separates some of the oil from an entering cockpit or cabin, if engine oil is present. And by keeping cockpit humidity low, less heat is required to defog the windshield.

The Stratos separator may be installed in any position—vertical, horizontal or diagonal—without impairing its operational efficiency, say designers.

The separator has a disadvantage, as outlined by S. E. Walker, Stratos senior research engineer—it reduces the efficiency of the aircraft's air cycle machine (refrigeration system) by holding up its storage of 45 in. Hg back pressure.

► **Engineering Details**—Stratos is what Stratos engineers did, in collaboration with Boeing design requirements, to the Model AP501 air cycle machine for

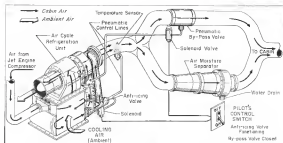


Diagram shows loading of Stetson air cycle unit and air moisture separator.

which the M660 separator was built as a comparison point.

When the air moisture separator was added to the G-47's air cooling system (between the discharge of the air cycle machine and the air inlet to the cockpit) it became necessary to maintain air cycle machine's discharge air at temperatures above freezing—because the separator will work only with water not ice. So Stetson modified its air cycle

machine to include a thermostatically-controlled air-boosting valve. A certain portion of the machine's exhaust air was directed to the discharge side of the machine's turbine. The thermostat automatically controls the amount of bleed air to maintain a temperature of 31°F in 3 deg.-at entry to the moisture separator.

The next step to give the crew maximum cooling was the installation of a

by-pass duct incorporating a spring-loaded valve around the separator. When the part was in its flying under atmospheric conditions which are as high as produce sudden valve flap to cut close the air-boosting valve and open the spring-loaded separator by-pass valve by flexing a switch. The pump is also operated automatically by a pneumatic switch when the aircraft enters altitudes at which low atmospheric bar-

a few words about alloy steels



OR...THE ALTERNATE ALLOY that never interrupted production

This could happen to you! A customer of ours was faced by restrictions and alloy shortages to which even the Republic alloy steel had been wrong for years to one of the alternate alloys that he could get. He'd develop the problems of reengineering tools and dies, of devising heat-treating procedures, of heavy repair runs while the switch was being made.

But these troubles never came!

He called upon the Republic 3-Direction Metallurgical Service... the Republic Field Metallurgist, backed up by the Republic Mill and Laboratory Metallurgists. These three men worked with the customer's metallurgist and his production foreman. Together, they analyzed his requirements, recommended the best available alternate steel, worked out the way to finish the steel and heat-treat it. The shift was made with almost no interruption, and never a headache.

We may be able to do the same job for you... and so back up our recommendation with one of the many fine alloys produced by Republic... world's largest producer of alloy and stainless steels.

REPUBLIC STEEL CORPORATION

Alloy Steel Division • Middletown, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

SALES REPRESENTATIVE: Chrysler Building, New York 17, N. Y.



Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Plates, Pipes, Bars, Wire, Flat Iron, Rails and Nuts, Bolting

The Accepted Standard the ORIGINAL

METAL CLOSURES

...by TUBING SEAL CAP INC.

We, Precision Metal Closures by Tubing Seal Cap were the FIRST on the market and remain the FIRST to this day.

For ten years, the Armed Services, major air craft companies and their suppliers have produced, mostly specialized Tubing Seal Cap Metal Protection for lines and fittings.

CHECK THESE FEATURES:

• Seal Out Dust and Moisture • Seal to Fluid • Resist Heat Shocks • Cor' Chlor • Easy Hydraulic Systems Clean • "Spin" On By Hand • Air Protection During Manufacturing, Shipment and Storage.

SEND FOR CATALOG

TUBING SEAL CAP INC.

Home Office and Factory: 228 W. Santa Anita Ave., San Gabriel, California.

Sales Office: 422 New Center Bldg., Detroit 2, Michigan.



SEAL PLUG



SEAL PLUG



SEAL PLUG



SEAL PLUG



SEAL PLUG



SEAL PLUG

BH

fabricators
for the
aircraft industry

B.H. AIRCRAFT CO. INC.

FARMINGDALE, NEW YORK

DYKEM STEEL BLUE **STOPS** **LOSSES**

making dies and templates

Diefly bonds on right at the handle, ready for the layout in a few minutes. The dark blue background makes the etched layout lines show up in sharp relief, and at the same time prevents metal stress. Inexpensive, efficient and accurate.

Write for full information

THE DYKEM COMPANY

2385A North 11th St.
St. Louis 8, Mo.



SERVOS MS501 unit weighs 3.5 lb., can handle 60 lb. force at 400



PLASTIC MODEL of MS501 motor separates three working parts

mach. provides constant, logging. Movement cooling is observed because when anti-icing valve is closed, all air led from the jet engine goes to the cooling turbine.

When spring-loaded valve is open, the turbine discharges air by passing the separator, thus clearing an appreciable pressure drop. Turbine efficiency is at its maximum then.

The spring-loaded valve also permits pilot to by pass the separator when air plane operates in duty or duty conditions which might plug the separator.

► **Heat Design**—The air separator separator is composed of three metal coil parts. Designed to work from air inlet to an outlet, they are:

• **Fog separator**—Control piece of Orifices collect minute particles of water which would fog up the tubes. They build up an air seal differential pressure differential flow.

• **Hotting assembly**—has two parts. The first, a vane motor control, traps large droplets of water, allowing the separator, against the outer wall of the separator. Second part, the stop water separator, draws moisture in the proper direction. The moisture can freeze and the driving turbine are mounted on a common shaft. Then are fabricated of sheet metal.

► **Draw housing**—Water drawn against the separator with a collector in the draw housing, then piped overhead.

Under superatmospheric barometric condition of 275 grams/lb. of estimated moisture, the machine attains its maximum efficiency and separates approximately 2 lb./min. of water, for a standard design flow rating of 50 lb./min. of air.

► **Easy Overhaul**—Stator engineers re-



WEBER
Airsewing
IN ACTION!

Sound answer to Crew seating

PROFESSOR 14 developed a Crew Seat to meet rigid military specifications and which could be subsequently modified to meet a wide variety of special requirements. Military Personnel insisted on adaptability, greater comfort, improved styling and a standardization of parts and sub assembly details.

WEBER AIRSEWING WENT TO WORK—A Crew Seat was developed to meet these requirements and with additional modifications provided on different applications. Built to USAF Specification 5009, a slight modification qualifies it for MIL-S-2012. The lowest seat has controlled 500° swivel positioning with steps in 45° increments. Weighing 42 lb. this pedestal type design has 5° of Vertical Adjustment with maximum height at low position. Floor track adjustment travel of 6". Adaptability was the keynote permeating these variations.



Why not take advantage of Weber's

"Bounce-to-deliver" action

let us help you on YOUR

airborne equipment problems

Call or write today

Airsewing

WEBER



WEBER AIRSEWING CORPORATION

2020 Ontario Street • Rahway, N.J. • Charleston 8-3542
Subsidiary of Weber Shovels & Pumps Co., Inc.

SPOT Mechanically Sealed, Solenoid Type No. 617PS, AN610P-1

SPOT Mechanically Sealed, Solenoid Type No. 600T, AN610-1

SPOT Solenoid Air Connector Type No. 617AAG, AN610A-1

SPOT Mechanically Sealed, Solenoid Type No. 60133

SPOT Solenoid Air Connector Type No. 6021, AN620P-1

SPOT Mechanically Sealed Solenoid Type No. 6046, AN610-1

SPOT Solenoid Air Connector Type No. 6016, AN610-1

All the above Relay Performance characteristics are as follows:

30 Amp. Inductive coil
Inductance of 25 mH.
4 Amp. Solenoid coil at 25 VDC.
10 Amp. Solenoid coil
112 mH. 400 cycles.
Coil 24-26 VDC.

Leach
FOR AIRCRAFT

CONTROL CIRCUIT RELAYS

Mechanically Sealed and Sealed

AN, AN AND MAP APPROVED: Illustrated above are but a few of the complete line of Leach mechanically sealed and sealed control circuit relays for aircraft.

Here are four of many important reasons why sealed aircraft control relays specify Leach relays: (1) to protect their rugged operation, (2) to reduce maintenance costs, (3) for better shock/vibration performance, and (4) because they lead to complete standards. Most modern aircraft are equipped with Leach relays from day one.

For Better Controls through Better Relays — Specify Leach

LEACH.RELAY.CO.

8715 AVIATION BOULEVARD • LOS ANGELES 3, CALIFORNIA

Representatives in Principal Cities of the U.S. and Canada

peak night-time maintenance for the airframe separator—except for one annual replacement of the agitator—because the machine contains only one moving part, its light rotating assembly weighs only 0.7 lb, and its rotating assembly turns at a relatively low speed—average is 6,000 rpm.

► **Early Problems.**—F. V. Stratos, Stratos' assistant to manager of customer relations, listed these problems among Stratos engineers when they undertook development of the air machine separator.

Airframe measurement of the main time constant in air is a tricky business. Stratos personnel worked up four independent methods of measuring separator efficiency before deciding which was the most accurate and least susceptible to human error.

Stratos engineers found it difficult to scale the unit to different sizes, and much research was devoted to knowing which dimensions were to be controlled. Stratos plans eventually to build a family of separators to cover the complete range of air cycle machinery.

► **Production Phase.**—Currently, Stratos is in production on the MS60-1 separator.

Model MS23 will be next (capacity of 20 lb/min of air), for lighter aircraft. Basic dimensions are length, 11.6 in.; maximum diameter, 5 in.; inlet and outlet sizes, 2.5 in. The MS20 should be available early next year.

A third model, MS35, is contemplated. This machine will be 17.5 in. long, have a maximum diameter of 7 in., and inlet and outlet sizes of 3 in.



SLIP-PROOF FOOTING

A new type of rubber matting, produced and marketed to home service employers by a new footing on slippery vinyl surfaces, is now on the market. The matting is made of a soft rubber, the matting is 7/16 in. thick and comes in rolls 24, 36 and 48 in. wide. Traffic Tread is made by American Mat Corp., 2313 Adams St., Eureka.

Here it is



*the
new high capacity
self-aligning
airframe control
bearing
DSRP series*

another FAFNIR first...

Fafnir DSRP Series Roller Bearings are scientifically engineered for full (30° total) misalignment and high capacity, consistent with the all important need for maximum weight and space.

Design advantages include simple construction and fewer parts — ideally balanced for auxiliary service in aircraft control systems. Elimination of bushing reduces inaccuracies and deflections in mounting — ensures longer bearing life.

The creation of this series is another example of the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the aircraft designer's viewpoint, on aptitude for coming up with the right bearing to fit the need precisely. The Fafnir Bearing Company, New Britain, Connecticut.

DESIGN ADVANTAGES

1. Full complement of forced lubrication system. The roller is oil-lubricated.
2. Split cage design provides for easy roller to cage clearance on both inner and outer rings.
3. Increased bearing life by providing greater clearance between rollers and cage.
4. Close fitting inner ring and outer ring design supports and aligns.
5. Precision finish. Precision finish.
6. One piece inner and outer rings.

Send for your copy

Our bulletin contains complete description, dimension diagrams, load rating table and performance graph.



FAFNIR
AIRCRAFT BEARINGS

MOST COMPLETE



ONE IN AMERICA

Mobile Units Speed

Engine Testing

Two new self-propelled mobile engine testing units are expected to save 3,800 man-hours a year and cut down some complaints have been developed by Cullin Aircraft Engine Service and are operating at Cullin, Calif., Municipal Airport. When a third unit, now under construction, is completed, the total cost will be \$35,000, considerably less than the minimum cost of a fixed cell.

Assembled on a low-draw trailer with two axles, the units are equipped with

instrumentation for checking engine performance, carry their own fuel load, and can be driven on the highway for work at any point accessible by ordinary vehicles. With quick-change fittings a complete engine change can be made in 45 minutes. Wheels could easily be replaced by ball or full tracks, for military use.

By being able to move away from the congested area of an airport, the units can operate 24 hours a day without the tubing system by their nose. The mobility of the unit also makes it possible for engines to face into the wind at all times, a help in accurate testing. The units are adaptable to various types and sizes of engines and can be

developed to check on horsepower available in the reciprocating engine field. At present, the firm is testing 1,800 and 2,250 hp. engines that power DC-4 and DC-6 commercial airliners. Mobile self-propelled units are in service at Los Angeles International Airport, where Western Air Lines uses a converted school bus, and at Skyflight Field, Denver. Continental Air Lines uses a pair of converted buses.

Plessy Starter Fuel Burns Without Air

A turbine engine starter, completely independent of external power sources, will shortly be put into production by Hamilton Standard division, United Aircraft Corp.

Built under license from the British Plessey Co. Ltd. the starter is a new atomized propellant liquid-fuel type, first of its kind to be manufactured in the country, according to Hans Stauder. The manufacturer adds that Plessey was the first to develop a successful starter using liquid-fuel which burns and produces energy without air.

Starters is operated by a single push button which causes the fuel to be ignited electrically. Combustion products spin a small turbine whose energy is transmitted to the engine through reduction gearing.

The unit is said to be easy to install, maintain and rechange. It is also light in weight.

Cost per start is low and number of starts is limited only by quantity of special fuel which is stored in the aircraft.

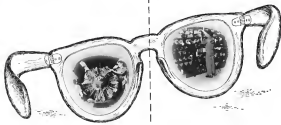


Pressure Switch Has Piston Element

A new piston-type pressure switch, used by its maker to be an improvement over conventional Bourdon tube and diaphragm types, has been developed by a group of aircraft applications by Debeck Mfg. Corp.

The unit is being used by Douglas Aircraft Co. on its Skyway F4D-1, A1D Skyhawk and F4D Skyhawk. Made

THERE ARE 2 SIDES... TO OUR BUSINESS



SPARE PARTS—FACTORY NEW

Everyone knows the part the Distributor plays in industry. AIRWORK fills this need with personalized SERVICE. How? By checking your order for accuracy, inserting speeding part numbers, completely accurate information on availability, immediate shipment from stock in most cases and continued follow-up of factory delivery dates. This service, coupled with fine cooperation from our manufacturers has resulted in record sales, increasing each month. We distribute for 22 manufacturers. Are you buying from AIRWORK?

OVERHAUL—EXCHANGE—SALE

Engines and accessories overhauled by AIRWORK Production lines are selling new records for dependability, extra performance and more economical operation. Pratt and Whitney Aircraft and Continental Motors Corporation approved. Are you using AIRWORK?



DISTRIBUTORS FOR PRATT & WHITNEY AIRCRAFT

Airwork
CORPORATION
MILLVILLE, NEW JERSEY

NEW YORK

MIAMI

WASHINGTON

Narrow, Floating

5/16-24 and 3/8-24

ANCHOR NUT



3600 SERIES

Flange 1/16" in all diameters. Maximum ANGLE ANGLE envelope. Maximum torque out and pull all strengths. Many applications (see ranges of specification AN-N 15 All metal (continuous plated surface steel), also all stainless steel available in 5000 series.

Size: All standard sizes 6-32 through 7/8-24.

WRITE FOR SAMPLES

Write us your letterhead for samples and 1960-1961 NUTTSHEL MANUAL. Manual explains dimensions (tolerances and material specifications).

Nutt-Shel

Manufacturers of self locking anchor nuts and bolt and nut retainers
881 AIRWAY, GLENDALE, CALIFORNIA
Circle 4-4771 Cityphone 5-3693





WRITE FOR YOUR SOLENOID Catalog

IT CONTAINS

- helpful data for selecting the right solenoid to solve your existing requirements
- general information about solenoid operation, life, known facts you need to know to specify the proper solenoid for your needs
- engineering drawings and specifications on most R&D production solenoids. One of these solenoids may meet your needs
- construction details. You can obtain dimensions and mounting requirements yourself, send us as far as your recommendations go. We'll do the rest for you. We'll also do the rest of the work if you want it. We'll also do the rest of the work if you want it. We'll also do the rest of the work if you want it.

ENGINEERING COMPANY
1000 E. 10th Ave.
South Salt Lake, Utah 84143

Special membership in the Pacific Coast
providing through quality solenoid technology.



Refuel on the eastern seaboard in South Carolina where retail fuel prices are the lowest and where airport facilities and service are unrivaled.

MAXIMUM PRICES
80 oct. 31¢
90 oct. 32¢
100 oct. 33¢

South Carolina—
Midway between
New York
and Miami

SOUTH CAROLINA
AERONAUTICS
COMMISSION



NBS SWISSAIR building has two engine test cells operated from one control room



P&W TWIN-WASP engine set up for Swissair test. Note old propeller tips (new)

Swiss Complete New Test Plant

Swissair's new engine test building, completed after four years of planning and construction, accommodates two cells—one for testing reciprocating engines up to 5,000 hp and the second for gas turbine engines. Tests are operated from a central control room, separated from the cells by triple-thick glass panes installed for observation.

Here are some highlights of the test cell:

- Engines are suspended on rubber reinforced steel cables to stop vibration from being transmitted to the building structure.
- Three thick pieces of glass, spaced 5 in. apart, help keep noise in control rooms down.
- Special railroads in the control rooms receive the slightest trace of en-

gine particles in engine oil system. • Ignition interface provides engines from being started until all conditions for safe operation of the engine have been satisfied. System also automatically shuts engine down in case conditions which might damage the engine arise. Typical examples are rising oil temperatures, low oil pressure and engine overspeed.

The Swissair structure, located at Kloten Airport, Zurich, is 137 ft long, 66 ft wide and 25 ft high. It is thoroughly soundproofed and an efficient air conditioning system supplies 275,000 cu ft of air to the control rooms every four min.

Testing and sound proofing equipment were supplied and erected by two British firms.

PRP "O" RINGS USAF 934 SERIES Fuel Resistant—approved to MIL-P-5315A



**assure
leakproof service!**

FUEL SERVICE
MIL-P-5315A
AS PUBLISHED
MIL-STD-130

HYDRAULIC SERVICE
MIL-P-5315A
AS PUBLISHED
MIL-STD-130

GEOMETRIC DIMENSIONS
MIL-P-5315A

Everyone is finding that PRP Fuel Resistant "O" Rings are the best for any type of Airplane or Jet Engine Fuel's either high or low aromatic content. They retain their resiliency at low temperatures, do not leak when dried out and are the perfect answer to all fuel leaking problems.

PRP can also furnish AN approved Compounds for use in Hydraulic Fluids, Synthetic Lubricants, to all Aeronautical Materials Standards and Silicone "O" Rings for High Temperature Services.

Write for your copy of our PRP Army-Navy Folder showing complete Specifications, Sizes and Compounds for all Military uses. Write today!

Precision Rubber Products
CORPORATION
The "O" Ring Specialists

Dept. 2, Oakridge Drive, Dayton 7, Ohio

**SAFETY
plus
ECONOMY**



with
**SMITH-MORRIS
EXHAUST
PIPES**



Here's quality of
Wright International design.

The old saying "A chain is no stronger than its weakest link" might easily be the axiom of aircraft design. No unit of the compound reciprocating engine is more significant for its efficient service than the lowly exhaust pipe.

Smith-Morris is proud of its contribution to the success of the Wright Turbo-Cyclone "18". In the field of high temperature sheet metal fabrication Smith-Morris quality ensures dependable and trouble-free service. Our experience may offer a solution to your fabrication problem.

SMITH-MORRIS COMPANY
AIRCRAFT EXHAUST HANDFOLD SYSTEMS
AND TURBINE PARTS AND ASSEMBLIES
FERNDALE 20, MICHIGAN

**NEW AVIATION
PRODUCTS**



Switch Boot

New high pressure boot for inflator or aircraft switch cover standard light weather. Cavit, designed to operate through a temperature range from -80 to 500°F, includes silicone rubber chemically bonded to a steel. It seals against the action of salt water, acids and ozone.

Ambromatic and Precision Mfg. Co.,
1115 E. 91 St., New York 28

Loop Improves ADF

Higher accuracy and faster response are among the advantages claimed for new Ferro-Dynascope loop being produced by Lear, Inc., for use with radio navigation equipment in executive aircraft. Component is designed for operation with firm's ADF 14 radio compass, and can be modified for use with ADF-12 Cyclone. It has ferrous core loop with electrical quadrant error correction.

Local division, Lear, Inc., 11196 W. Penn Blvd., Los Angeles 64



Obstruction Light

Double obstruction light for placement at airports or along air routes comes from Genl Electric Co., Ltd. Two specially designed and patented glass domes give symmetric light distribution with maximum intensity 10 deg. above horizon. Body is aluminum-aluminum alloy casting. Length 60 7/8 in.

General Electric Co., Ltd., Magor Road, Kington, London W. C. 2

**CHICAGO & SOUTHERN, UNITED, and CAPITAL AIRLINES
USE SOUTH WIND HEATERS FOR
COMFORT
ON THE LINE!**



NEW mobile aircraft air conditioner by Airtemp
brings complete all-weather comfort to airliners
with *South Wind* heaters

Complete on-the-ground, all-weather comfort for airline passengers is achieved by this new mobile air conditioner by the Airtemp Construction Corporation.

Airtemp chose Stewart-Warner South Wind Heaters, acknowledged leaders in the field of aircraft heating, for dependable cold weather operation. The heater supplies up to 200,000 BTU's—more than ample, even for arctic opera-

tion—direct to the plane's own ventilation system. Stewart-Warner supplies the electric fuel pumps and instruments, as well.

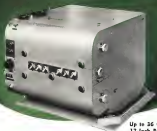
Already chosen by Chicago and Southern Air Lines, United Air Lines and Capital Airlines, the unit is finding ready acceptance by the industry for its dependability and ease of operation. Another example of South Wind leadership.

South Wind
AIRCRAFT HEATING
AND THERMAL
ANTI-ICEING EQUIPMENT
INERT GAS GENERATORS

Home Installation: Only the danger of the heater is visible. The South Wind heater itself is so compact that it fits completely inside the door, yet supplies up to 200,000 BTU's of heat to cabin and cockpit.

Left hand panel of truck with engine door open for inspection to service. Being a direct in comparison. The instrument panel on the right enables Stewart-Warner liquid level and temperature gauges.

for ease of INTERPRETATION and
REDUCTION of RECORDED data



Up to 36 Channels On
12-inch Paper or Film

Midwestern Model 570 Oscilloscope

This accurate, rugged instrument was designed for industrial and laboratory testing requiring numerous channels, each of which should have clear definition for accurate reading. It will record up to 36 channels of separate data on paper or film 12 inches wide. Dimensions are: 14" x 18" x 19" (including base). Weight is 89 lbs (including base). For use in the oscilloscope Midwestern offers a wide variety of precision galvanometers with undamped natural frequencies up to 3500 cps. Write for complete oscilloscope and galvanometer specifications.

FEATURING . . .

- Two separate daylight-loading magazines for exposed and unexposed recording paper
- Trace identification (beam interrupter type)
- Precision tuning-fork-controlled electronic timer.
- Graduated external viewing screen.
- Continuously-variable paper speed
- A wide selection of optional special components.



MIDWESTERN GEOPHYSICAL LABORATORY

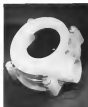
3401 S. HARVARD TULSA, OKLAHOMA



Pulley Guard Pin

A new quick disconnect pulley guard pin meets National Aircraft Standards approval down with use at roller pins. Spring clip on pin depresses while it is being pushed through hole, then snaps out on shoulder of hole to lock pin against rotation.

A. A. Metal Products, Inc., 6280 S. Central Ave., Los Angeles 1.



Plastic for Blower

Plastic grids for aviation gray blower motors are used to seal bearings. They are made of Libby Owens-Ford Glass Co.'s glass-reinforced alkyd molding compound for Electroflow Plastics, Inc., Los Angeles. They serve as isolated bearings for the cooling pumps through temperatures from -55 to 125F. Seals are fabricated by Badger Plastic Products, Los Angeles.

Clearance Training

"Photograph Records to Practice IFR Clearance" is a set of three 75 rpm transparencies designed to help pilots overcome the confusion of tangled air port procedures.

This method provides realistic instruction available anywhere at any time—without leaving IFR weather-for the student pilot, master of the records class. Old methods have been for the instructor to read hypothetical IFR

THE GREY LINE...



WOULD BE *thinner* STILL—

Between hostile bombers and big strategic bases in the United States stands a thin grey line of all-weather jet interceptors—our primary defense against invasion.

This thin grey line would be thinner still were it not for the Lockheed F-96. Combining solid wings and solid aluminum fuselage with a power design, it brought jet-age protection to a new field.

To meet the daily day, to seek and destroy the enemy in all weather... requires much performance. The first electronic requirement... is equally important... demands from you.

A W. Haydon precision wing help give jet wings to F-96. A specially designed program timer counts down phase current in sequence through jet electrical heating elements at the leading edge of wing and tail.

This application of specialized A. W. Haydon timing equipment solves the problem of simultaneously advancing constant fuel distribution and peak heat concentration there to eliminate jet maximum weight.

A wide range of timing products maintains jet timing accuracy and being solved with precision A. W. Haydon timers, custom designed to your specific requirements.

WHEN TIMING POSSES A PROBLEM... CONSULT THE A. W. HAYDON COMPANY

Write for our new complete timing



**A. W. HAYDON
COMPANY**
332 NORTH ELM STREET
MILWAUKEE 26, WISCONSIN
Export 81 Milwaukee of American Italy Sales

CONTINENTAL AIRCRAFT ENGINES

ARE STANDARD IN MOST OF
TODAY'S UTILITY PLANES



CONTINENTAL MODEL 1000
411 hp at 2300 rpm
715 hp at 2500 rpm

IT IS a tribute to the quality of Continental engines, as well as to the judgment of corporate and individual owners of utility type planes, that on overwhelming majority of such planes in use today fly with dependable Continental Red Seal power.

REMEMBER, CONTINENTAL BACKS YOU WITH SERVICE
WHEREVER YOU FLY

Continental Motors Corporation
Aircraft Engine Division
MUSKOGEE, MICHIGAN

classroom to his students, or to work for bad weather to learn to assist control towers giving strict 10-8 clearance.

The second course 25 inscriptions of actual classroom in many cities through the country. The instruction is set to conform to CAA-approved procedures.

Helco Aircraft Supply Co., Dept. B, 1474 Airport, Morris, N. Y.

Scraper Rings

Scraper rings for piston parts in aircraft components are being made to AN 6231 requirements by Gidgets, Inc.

The rings are designed to remove soot, dirt, dust and other foreign matter, preventing excessive wear of 12 rings and precision parts. They are available in sizes from 1 to 13 in. inside diameter.

Approved under Spec MIL-S-5049, the scraper rings, called Super Seals, are said to exceed wear requirements by 100%.

Gidgets, Inc., Dayton, Ohio

ALSO ON THE MARKET

16-strand ignition cable for subsonic and general use is believed first to meet Bureau of Ordnance approval under Spec. MIL-C 3162 as Type 1 Grade C, Class 1. Approval includes Grade A seal to in addition to other certifications already secured under the MIL spec for cable of this type, a 5 amp gauge consisting of a stainless steel conductor covered with synthetic rubber insulating, a glass-reinforcing braid and over all low temperature sheath. Cable is made by General Electric Co., Bridgeport, Conn.

Product miscellany: New data sheet describing best means of using temperature-indicating liquid, Torsling, and various outside effects on this agent is available from Tempal Corp., 11 W. 25 St., New York. Japan guide on the engineering equipment and accessories put out by Frytetter Co., Dayton, contains much general information. A drafting template to save time when drawing 10-32 size rivets may be obtained from 10-32 Rivet Tool Co., 3524 Bellvue Ave., Los Angeles 45.

A 14-mm. version of the Seif 10-17 15 mm. starter spark plug has been put on the market by the Seif Spark Co., 10 S. Duane Ave. Co. Labeled the B 73, the plug was designed for use in CAA-approved 10-17 engines, according to the manufacturer. The B 73 is resistant to lead fouling and retards radio interference. Seif Spark Co. address: 217 49 St., N.E., Canton, Ohio.



it's a matter of

PRECISION!

The lift, the power, the drive... yes, the airframe heart...

of the YH-21 Sikorski "woon-woon" helicopter are followed by the three transmissions shown here... the forward, mid and aft.

For this kind of component fabrication, the best single source for the precision for which Steel Products is famous!



"Precision in Aviation Since 1914"

THE STEEL PRODUCTS ENGINEERING CO.

engineers and manufacturers • Springfield, Ohio

INFORMATION on positions at NORTHROP

Northrop Aircraft, Inc. is engaged in vitally important projects in scientific and engineering development, in addition to aircraft production. The program is diversified, interesting and long-range. Exceptional opportunities await qualified individuals.

The most responsible positions will go to top caliber engineers and scientists. However, a number of excellent positions exist for eligible but less experienced engineers. Some examples of the types of positions now open are:

BOMBING SYSTEMS
RESEARCH SCIENTISTS
ELECTRONIC PROJECT ENGINEERS
ELECTRONIC PROGRAMMATION ENGINEERS

FLIGHT TEST ENGINEERS
DESIGN ENGINEERS
NAVY MECHANISTS
ELECTRO MECHANICAL ENGINEERS
ELECTRICAL INSTALLATION ENGINEERS

Qualified engineers and scientists who wish to help in personally in Southern California are invited to write for further information regarding these interesting, long-range positions. Please include an outline of your experience and training. Allowance for travel expenses.

Address correspondence to:
Director of Engineering,
Northrop Aircraft, Inc.,
1600 E. Broadway,
Hawthorne, California

FIRE POWER!

The U.S. Air Force's F-49 employs all-weather interceptors, seamless dovetailing, firepower, advanced electronic equipment and high speed for its vital defense task. Designed and built by Northrop Aircraft's forward engineers and craftsmen, these new aerial destroyers are now on guard in the U.S. air defense system.

NORTHROP AIRCRAFT, INC.
HAWTHORNE, CALIFORNIA

PIONEER BUILDERS OF NIGHT AND ALL-WEATHER FIGHTERS

AIR TRANSPORT

PNYA Predicts Mass Copter-Commuting

- Annual traffic by 1975 may exceed 6 million.
- Survey shows New York will need 6 helicopters.

Helicopters will be carrying more than 6 million passengers annually in and out of Manhattan by 1975, according to a new study by the Port of New York Authority's three big terminals at Idlewild, La Guardia and Newark. That grant development of transport helicopter service is a first in a special long-range survey ordered by Port of New York Authority officials.

Approximately 100,000 passengers can be added in 1955 to trips in the metropolitan New York area, the survey predicts, providing there is at least one heliport conveniently located in the Manhattan area.

• **Heliports**—At least six heliports will be required in New York and three in Manhattan (two in midtown, one downtown), the survey in Brooklyn, Newark and Staten Island. Another heliport will be required atop the main Post Office building in Manhattan to take care of all-midnight copter routes. It is estimated that landings and takeoffs from the six passenger heliports will run from a total of 221 daily in 1955 to 513 daily by 1975.

At the start of passenger-carrying service, operators will face direct operating costs of approximately \$0.09 per available seat-mile, or about four times the present level for fixed-wing carriers, because the copters initially will be modified military designs. Later, larger but still intermediate military types will permit lower costs in the \$0.05 to \$0.07 per available seat-mile range.

In 1960-1965, specifically tailored commercial copters will bring available seat-mile costs down to \$0.05 to \$0.06. Seat-mile costs will go down still farther with the advent of \$2.00 passenger-craft capable of operation at \$0.045-\$0.05 if powered by piston engines and possible \$0.035 with turbine power.

• **Folding Rotors**—Blades-Folding rotor blades will include significant in lower maintenance costs. For simplicity of protected area heliports, as those on copters, retractable folding rotor blades will be required.

In order to meet competitive fixed-wing with short-haul flights, rates and

Estimated Annual Helicopter Passengers New York Metropolitan Area

	Annual	Intercity	Suburban	Total
1955	225,000	75,000		300,000
1960	1,177,800	791,000		1,968,800
1965	1,873,800	1,274,000	516,000	3,663,800
1970	3,536,000	1,555,000	1,012,000	6,103,000
1975	5,688,000	1,796,000	1,016,000	8,500,000

Estimated Intercity Helicopter Letter Mail Both Directions—New York Area

	Domestic, B (millions)	Overseas, B (millions)	Total, B (millions)
1955	0.5	0.2	0.7
1960	1.4	0.5	1.9
1965	3.4	1.3	4.7
1970	5.5	1.9	7.4
1975	7.8	2.7	10.5

Estimated Helicopter Package Cargo Both Directions—New York Area

	Total 4th-Class Service, B (millions)	Annual Diversion to Copter (millions)	Lb. of Package Cargo (millions)
1955	250.44	0.5	1.0
1960	399.17	1.8	2.4
1965	747.02	5.7	7.7
1970	1,260.70	2.0	2.1
1975	2,513.00	2.5	6.6

times, copter operators from the start will have to provide new operational techniques and service standards, the report points out. They will have to guard against too ready acceptance of traditional fixed-wing aircraft methods. It is estimated in the study that a minimum of 13% can be saved on copter operations over such short-haul transportation at local service rates without such surcharges.

For levels from 1955 to 1960 probable will range from 33.13 cents per revenue mile, if the operators get paid and some government subsidy. This basic rate should go down to 10 cents by 1960 if copter services can maintain current costs at 1 cent per passenger mile. In the following decade, free

might decline to 6.575 cents per passenger mile.

• **Local Patterns**—To capture the huge short-haul traffic volume that awaits transport helicopter operations in the New York area—more than 25 million people live within 150 mi. of Times Square—highly specialized traffic patterns will have to be developed to maintain profitable performance.

Deliveries will require free-landing and rotary-wing traffic and the right jobs will require low-powered visual aids, and dynamic motion-sensing equipment, according to the study. Manhattan will be the pivotal point for most helicopter services.

The latter factor will encourage growth of on-called aircraft (fixed-

(door-to-door) service. At present men from half of all active passengers using Idlewild-La Guardia-Norfolk Airport start or end their trips in Manhattan. During 1952-1977 it is estimated that active passengers at these airports will increase to approximately 14.6 million. By 1963, according to the study, approximately 25% of the active passengers who normally would use Idlewild will shift to other airports and more 10% of Idlewild's air will use airports. At the time, passengers were to pay less than 70% higher than the actual fare.

► **Future Connections**—The suburban streets generally will be most attractive at the start to executives and other businessmen willing to pay less since five times the cost of train commutes for a comparable service in travel time. This travel time is expected to lengthen as more and more businessmen continue the exodus from the tightly packed city center farther out into neighboring communities. The survey expects that both airports will cut by 50% travel time to Manhattan from within a 30-175 mi area.

Helicopters also will take on an important portion of the local bus and package cargo business. In the 30-175 mi area surrounding Manhattan airports will take on approximately 15% of the traffic carried by surface from 1977. And it is predicted that by the time dual airports will carry a volume of fourth-class mail equal to 70% of that carried on the surface.

Indonesia Plans Airline Growth

(McGraw Hill World News)

Malaysia—High priority has been given to a five-year civil aviation program in Indonesia. Discussion on aviation between the Indonesian government and KLM Royal Dutch Airlines covering the status of Garuda Indonesia Airways with a view towards giving the company a larger role in airline development.

Current emphasis is to be placed on developing inter island services and construction of new airports and better communications.

Garuda carries approximately 25,000 passengers monthly in its month, which is equal to Singapore and the Philippines. Some 30% of the carrier's revenue is derived from cargo. Employment was about 3,700. Its fleet is being expanded to 30 aircraft, 16 Comets and the remainder to B-747s.

Most of its planes are sent to Australia when they need extensive overhaul or repairs but there are plans to build up domestic facilities.

Airfreight Needs and Problems

- Industry generally finds basic need of:
- Specialized freight terminals
- Special planning devices
- Few parking of loads for destination
- Concerns for light loads
- Specialized vehicles for heavy loads
- Stronger plane docks
- But they do not yet agree how:

- Passenger lines want combination freight terminals adjoining passenger terminals
- All-cargo operators want separate freight terminals at airports—but airport managers can't build until the cargo gets an specification
- Flying Tiger wants full bed and deck lift trucks
- Douglas Aircraft and others want second docks
- Port of New York Authority wants mostly overhead and belt conveyors
- Douglas Aircraft wants pre-loading of loads

- Railway Express Agency wants conveyor belts
- Military wants pre-loading of even larger loads
- Passenger airlines say pre-loading won't work commercially
- All-cargo lines are in the middle on pre-loading
- Airlines want stronger plane docks for heavy loads
- Manufacturers want greater vehicles for loading heavy items on plane docks
- Flying Tiger Line wants plane dock beds
- United likes them but says they are in water
- Whiting Corp. recommends its Load-a-dolly system
- Lockheed wants bigger planes, with 75,000 lb payload
- Flying Tiger wants planes low to the ground—touch bed level
- Douglas Aircraft says freight planes will be conventional

Airfreight Handling Needs Cited

Air cargo industry would like better ground facilities, but airport operators say carriers must set up specs.

The air cargo industry last week got a few basic answers and a lot of disagreement on solutions to its basic cost problem—lack of specialized freight-handling facilities at airports.

All-cargo operators, combination passenger-cargo lines, freight forwarders, exporters, manufacturers and airport managers—all with ideas on what freight-handling facilities will end the present inefficient head-to-head load/unload system—tried to find the answers at the fourth annual Society of Automotive Engineers Conference on Air Cargo in New York's Hotel Statler.

They agreed relative merits of conveyor belts, overhead conveyors, mobile equipment and various plane designs like the low-dock Lockheed XC-130 and the detachable-bed concept of the Fairchild XC-120.

► **Dock Systems**—But the simplest and apparently most successful solution was a dock system proposed by Douglas Aircraft Co.'s equipment engineer—H. O. Olson. The dock would have adjustable lifts from terminal floor to plane deck, similar to but longer than a gangplank. Hinged at the terminal end edge, the 90-ft dock stretches straight out to the cargo door of the plane. It is wide enough to accommodate a conveyor system and fit vehicles to maneuver with big loads.

Olson recommended that the terminal end of the dock be about 110 in. high—slightly lower than the Stratoslighter

C-47, but even with the C-124, C-47, C-54 and DC-4 types, and slightly higher than the C-46 and Fairchild C-119. (Olson would make loads up two degrees for the Stratoslighter, to allow three degrees for C-46 and C-119.)

On plane design, Olson points out that freight-plane deck levels vary now and probably always will. Furthermore, he said, neither the deck level nor the deck design and size have anything to do with solving the basic problem how to get cargo from terminal to airplane.

Once you have the dock, Olson concluded, "outside handling" equipment can take the loading means to the loading problem—conveyors for lighter loads, vehicles for heavier items.

The terminal work docks, supported by specific structural handling devices, should allow loading, at a rate of about 3,000 lb. per minute.

The major problem then becomes getting heavy equipment into the plane without damaging the floor.

► **Heavy Loads**—Stronger floors and greater loading devices were both recommended and probably will evolve.

Comments noted that Lockheed's new extended suspension B-58 in the 1940s and XC-130 were a good structural. Flying Tiger Line has installed two such floors already on a C-46, with CAA approval of more than 400 lb. per sq. ft. Olson called for 60-lb.

FOR PRESERVATION
Shocks Engines-Auxiliary
Cabin Superchargers



for TRAINERS OR TRANSPORTS

More and more air lines and manufacturers are depending on Stratostream for preservation and air cycle cooling equipment. The outstanding service given by Stratostream cabin superchargers and air cycle refrigeration units has led to adoption of Stratostream units in military aircraft and in many transports, both as original equipment and as replacement units. A complete Stratostream system has been selected for the new Beech T-36A trainers being built by both Beech and Cessna. Cessna's and Cessna's 240s used by leading American and foreign flag carriers fly with Stratostream equipment.

FOR COOLING
Stratos Air-Cycle
Refrigeration Units

For information on this and other Stratostream equipment, write:

STRATOSTREAM
DIVISION
JANNEY ENGINE & AIRPLANE CORPORATION



STRATOSTREAM PRODUCTS
Air-Conditioning • Refrigeration • Cabin Superchargers
Air-Blow Refrigeration Equipment • Other Airplane Parts

Main Office and Plant: Raytheon, Long Island, N.Y. • West Coast Office: 1722 Westwood Blvd., Los Angeles 24, Calif.

DESIGN STAFF ENGINEER

Transmission

ROAD experience in general design and transmission design, including experience in manufacturing equipment. Experience in service as service engineer. Capable for transmission design at staff level, and, in connection design problems with motor manufacturers. A degree in electrical engineering or prefer. Please, resume, but no telephone will be accepted.

DESIGN STAFF ENGINEER

Electrical

ROAD experience in general electrical design. A degree or diploma in electrical engineering or equivalent, plus experience in electrical design and manufacturing equipment. Experience in service as service engineer. Capable for electrical design at staff level, and, in connection design problems with motor manufacturers. A degree in electrical engineering or prefer. Please, resume, but no telephone will be accepted.

INDUSTRIAL ENGINEERS

INDUSTRIAL or mechanical engineering degree or equivalent, plus experience in engineering manufacturing equipment. Experience in service as service engineer. Capable for industrial design at staff level, and, in connection design problems with motor manufacturers. A degree in electrical engineering or prefer. Please, resume, but no telephone will be accepted.

HELICOPTER TEST PILOTS

Work and test over 250 hours of helicopter time.

A-1-C-2

DRAFTSMEN

With two to five years experience, and a diploma in draft.

Send complete resume, including salary requirements, to: EMPLOYMENT MANAGER.

PIASECKI
Helicopter Corp.
Department "A"
Meriden, Pa. A. Phila. Suburb

most of a leading vehicle with wide weight distribution. Other panel members noted that new lightweight pellets are coming onto the market here, which would provide basic damage.

Airport Manager-Toronto will be held when operators decide on specifications, various airport opportunities will.

CNA reports engineering chief Philip A. Hulse led off the discussion of freight terminals by proposing the excellent position. Ground handling on the terminal interior layout, he said, is the "quantity" of the aviation industry. He and his engineering services of a typical freight operation showed that 55% of its interest time for goods shipped from New York to Detroit was taken up by ground handling and only 15% was spent in the air. Then at the New York-Los Angeles route, 57% of the airfreight time between shipment and receiver is spent on the ground.

CNA comments forecast a threefold growth of air cargo from last year to 1968, Hulse says. By 1975, explained cargo will hit \$14,000 a year and by 1980 it will reach \$38,000 a year. This would cut truck, 400 million in 1975 and 750 million in 1980.

International Operator's View-Scotland & Western vice president of operations, Carl D. Hall presented a paper, "United Nations Freight Development in Relation to Air Logistics." He and TWA and Pan American's transatlantic passenger fleets "cannot be used to carry large items of freight," necessary to support a military force in the field, without the same condition. Therefore, he said, "The value of the transatlantic freight industry to our national defense is in direct proportion to the volume of long-range freight capacity of our armed forces people in an emergency to help meet the requirements of the military establishment."

He cited the military priority schedule of Military Air Transport

Service, which, he said, "has been first... preference to the DC-6A, an all-weather aircraft, second priority to the long-range heavy cargo type DC-4 and third priority to the medium-range light cargo type DC-4. Combination (passenger) aircraft follow." Yet, he points out, shortage of commercial cargo planes among the airlines is such that the civil transportation situation of airlines for emergency MATS duty is 40% DC-4s and only 5% DC-6As. New cargo planes on order are three DC-6As by Pan American and four 104RB Super Constellation by Southern. He says Southern's Super Constellation, slated for early 1974 delivery, will have capacity to load 13 tons per flight across the Atlantic.

Then comes the all-weather freight planes in Europe, "which will make it possible for millions of pounds of additional traffic now moving on the surface to move by air." That increase will lead to better, more DC-6s and Super Constellation freighters, he said, but what is really needed to "generate a constant flow of billions of pounds" is a still bigger and more economical plane. That he said should be a 75,000-lb. pusher plane with direct operating cost of four cents a ton-mile.

Nomadic Rights to Sheds

(Matthew Hill World News)

U. S. citizens have been given permission by the Canadian Transport Board to operate nomadic shelter services between a number of U. S. Canadian locations, according to their scheduled services.

Included among the carriers are Pan American World Airways, Seattle-Whitcomb, Western Air Lines, Great Falls, Mack Lehigh and Edmonton, Alaska, Northwest Airlines, Farnham, D-Wing, Northeast Airlines, Boston-Manitoba, Colonial Airlines, Washington, D. C.-Montreal Ottawa, and American Airlines, New York-Toronto.



BRITISH AIRLINES TEST FIDO

Three different types of British transport aircraft line up on a runway at Heathrow Airport, Surrey, England, highlighted by the giant of hangar glider used to fly the long haul (left). The test was to ascertain pilot and passenger reaction to

Fido, and in World War II it was the first aircraft to fly over the North Atlantic. Shown in photo (left to right) are a Vickers Viking, Alcock and Curzon and an Avro York.

Aviation Safety

Prop Reversal

- **Ham Standard refutes CAB crash findings.**
- **Prop on DC-6 reversed on impact, report says.**

(Editor's Note: For the purpose of drawing additional light on the highly important question of standardizing propeller reversal, Airline World herewith presents an editorial report on some technical studies of engines conducted, but not accepted, by CAB in arriving at some recent findings. The report mentioned are in the public files of CAB in Washington.)

Did the No. 3 propeller of the National Airlines DC-6B that crashed at Elizabeth, N. J., last Feb. 11, as it was in flight?

Although Civil Aeronautics Board has issued a report finding that as yet in flight was the principal cause of the accident (SAFETY WEEK FEB. 28, p. 48), the conclusion goes contrary to a little-known technical report submitted to the Board by Hamilton Standard propeller engineers.

The Hamilton Standard report, based on examination of parts of the No. 3 propeller recovered from the wreckage and correlated tests with identical propeller parts, states that "the only reasonable explanation, accounting for all conditions is that the propeller was in positive pitch position at the time No. 1 blade became fractured" (at the last impact of the plane with the road as an apartment house into which it plunged).

• **Standard Flight:** The propeller parts report is supplemented by a flight-test report made at Hamilton Standard's request by United Air Lines pilots at San Francisco in a DC-6B in which the No. 3 propeller was reversed in flight as an effort to simulate flight conditions at

the Elizabeth accident. The flight test report also is on file with the Board. Yet a third interesting technical report bearing on the question of reversal was made by the National Bureau of Standards at CAB's request from the wording of CAB's accident findings, it is evident that the Bureau of Standards report was used as a partial refutation of conclusions by the Hamilton Standard engineers.

Here is what *Yankee Evening* and R. P. Luskoff, Hamilton Standard engineers, reported:

Examination showed Nos. 3 and 2 propellers were in positive pitch. No. 3 was in full reverse and No. 4 propeller was at half blade angle with no indication it was in full feathered position at the time of impact.

• **Further Study:** Warranted—Unusual conditions in No. 3 propeller were considered to warrant further study.

Two experiments on a blade internal structure which plots, one light but delicate, one rather dense of No. 3 propeller, showed the blade was in positive low pitch, and the other experiment very severe, indicating full reverse pitch. None of the other metal parts showed such results.

• **Experiments on parts:** One of No. 3 propeller, covered by leaving surface of the positive low pitch stop inner, and differing from several test results.

• **Low pitch stop wedge:** No. 3 propeller showed indications of being slightly cocked from its normal position and had a severe misalignment on its surface.

• **Shall fracture:** No. 1 blade of No. 3 propeller showed under examination that the blade had been caused by an impact had applied against the leading edge of the blade with blade at a positive angle of about 30 deg.

• **They conclude:** That the propeller was forced past the positive low pitch stop by impact (in upward low pitch) in striking the palm sleeve and wedge. Thus the propeller subsequently reversed in full reverse pitch, at which point No. 2 and 3 blades became fixed.

They cite recent flight tests, present

ALLEN AIRCRAFT for Dependability



DROP TANK VALVE
Sealing or Non-Sealing



OXYGEN COUPLER
AN 600-2A or 1B



PRESSURE RELIEF VALVE
Line Mounted



SELF-LOCKING DRAIN VALVE
Straight or Pipe Thread

Allen offers complete engineering, designing and production facilities for custom engineered fuel system components. Contact us or one of our authorized representatives. You're ready with your special requirements and specifications.

SALES: W. H. Allen & Co., 10000
Long Island City 1, N. Y.

WEST COAST: The Thrust Co.
Los Angeles, Calif.

DISTRIBUTORS: Sales Division
St. Louis, Mo. & Tulsa, Okla.

MOUNTAIN: Fred Fox
Phoenix, Ariz. & Denver, Colo.



Products, Inc.

P. O. Box 95, Bevanon, Ohio

Phone 7533

SAFER LANDINGS SELL MORE PLANES

You'll sell more planes when they're equipped with AEROMATIC... world's only automatic variable pitch propeller for personal planes. Series that's safe, reliable, modern & plans get up to 100% more power, less wear for more. KOPPER COMPANY, Baltimore 5, Maryland.

The propeller with a built-in personal plane.



(Detailed color picture of a Ford Thunderbird Coupe.)

Engineers and OTHER TECHNICAL PERSONNEL Needed DALLAS, TEXAS

AERODYNAMICS
POWER PLANT
ELECTRONICS
STRESS ANALYSTS
SERVO MECHANISMS
STRUCTURES

CONTROLS
WEIGHT CONTROL
LIAISON
MECHANICAL
MATERIAL PROCESS
LOFTSMEN
ENGINEERING PERSONNEL SUPERVISOR
DRAFTSMEN

HOUSING AVAILABLE - TRAINING FACILITIES - PENSION PLAN
PAID VACATION & HOLIDAYS - GROUP INSURANCE
EXCELLENT WORKING CONDITIONS

ATTENTION
ENGINEERING
PERSONNEL



BOX 6791
DALLAS,
TEXAS

Engineers

AN INVITATION TO YOU TO GO PLACES WITH FAIRCHILD

A secure future, exceptional opportunities for advancement, and a high starting salary await you at Fairchild. We have openings right now for qualified engineers and designers in all phases of aircraft manufacturing.

Good vacations, liberal health and life insurance coverage, 5 day, 40-hour week, a bonus program in place when longer work week is scheduled.



Earl E. Horton, Chief of Aerodynamics. Has had salary raises of 10% for his experience in aircraft manufacturing and is responsible for engineering and design work in aircraft research.



CHIEF AND ENGINEERING DEPARTMENT
FAIRCHILD Aircraft Division
HARTFORD, CONNECTICUT

BE A UNITED PILOT



Applications Now Being Accepted
For 1952 Training Classes

There is no error in commercial aviation with one of the nation's leading airlines. Pay is excellent and there are ample opportunities for advancement. Retirement Income Plan, bond Insurance Program and many more benefits.

QUALIFICATIONS:

Age 21 to 35

Height 5'6" to 6'2"

Vision: 20/20 without correction

Education: High School graduate

Citizenship: Must be U.S. citizen

Flying Experience: Must have valid CAA commercial license and first class endorsement will be given applicants who also possess commercial ratings.

Apply now to:

UNITED AIR LINES

Wm. C. M. Shook, Dept. 241
Box 100, 1000 Operating Room
Washington Field, Denver 2, Colorado

ENGINEERS DESIGNERS

Opportunity in an established
and growing company

Engineering & Research Division
OF
ALL AMERICAN AIRWAYS, INC.

DuPont Airport
Wilmington, Delaware

CO-PILOT MECHANIC

For highly motivated and experienced pilots, we offer a unique opportunity in a growing company. Plus competitive salaries and excellent benefits. Apply now to:

P-5079 AVIATION WEEK
300 N. 4th St. New York 36, N. Y.

RESEARCH AND DEVELOPMENT

Forge the KEY to America's future in the AIR
take YOUR place . . . with GOODYEAR AIRCRAFT

The continued and steady growth of established research and development projects presents a number of unusual opportunities for outstanding and experienced men.

SCIENTISTS

ENGINEERS

DESIGNERS

Positions are available in our organization for qualified personnel in the following fields:

- Electrical Systems
- Circuit Analysis
- Analog Computers
- Servomechanisms
- Test Equipment
- Structures
- Aerodynamics
- Applied Mathematics
- Electronics
- Physics
- Stress Analysis
- Flight Test
- Missile Design
- Dynamics
- Microwaves

Openings also exist for welding engineers, civil engineers, and mechanical engineers with experience in metal fabrication, and for personnel with ability and experience in technical editing, art, and motion pictures.

Positions are available at several levels, and inquiries are also invited from recent graduates. Salaries are based on education, ability, and experience. Liberal salary, vacation, insurance, and retirement plans are yours if you qualify.

If YOU are interested in a secure future, write, giving full details, to
Mr. C. G. Jones, Salary, Personnel Department.



GOODYEAR AIRCRAFT CORPORATION, 1210 Massillon Road, Akron 15, Ohio

The Complexity Problem IV

[Author: Where continues its series on the important subject of aircraft complexity with this report from within the Air Research & Development Command of the U. S. Air Force. (By: Gen. Leighton I. Dorn is director of research in the Office of the Deputy for Development of ARDC. His comments below were delivered before the Cleveland-Mass. Section of the Institute of the Aeronautical Sciences, with the title, "The Weapons Systems Concept." This will be concluded next week in this page—KHW.)]

By Brig. Gen. Leighton I. Dorn

There has, in recent weeks, been a lot of public discussion of the size and complexity of our military aircraft. I have been asked to speak about the "weapons systems" concept. The subject is related to the trend in modern aircraft toward increased size and increased weight of equipment.

Armament, including radar, fire control, and automatic pilots, is becoming one of the blazes for the increasing weight. This equipment is absolutely necessary to convert the airplane into a weapons system. How well and how efficiently we are accomplishing this task is obviously not a subject for public discussion because the essential factors must remain classified in military secrets.

I can assure you, however, that our design problems are being solved by companies such as General Electric, Westinghouse, Hamilton, General Motors, etc. Armament is being done by organizations such as Bell Laboratories, Massachusetts Institute of Technology, California Institute of Technology, and others. The Air Force has no armament to do the Army and the Navy. The design of this equipment is entrusted to the best brains of the nation and electronic industry. I believe that if there is an over and under way to meet our military requirements, their top flight concerns will find it.

One present armament component is the outgrowth of two strong influences:

a. World War II developments—radar, electronic aim, precision bombs and automatic control theory.

b. Operational requirements for performance in new regimes of speed, altitude, and range.

Overloading these influences is the aircraft loads. It is no wonder that the past few years have produced aircraft systems that have so much trouble in the equipment used in World War II.

The airplane has been dominated by the availability of jet propulsion making possible impressive speeds. The low propulsive efficiency of the jet engine necessitates large quantities of fuel to meet military requirements in terms of radius of action. Fuel requirements determine aircraft size more than do fuel.

Since World War II we have been to integrate these developments into a "weapons system." The result of that integration has produced aircraft that are definitely different from the aircraft of World War II and from the conventional aircraft of the transportation industry.

I have viewed the size of modern aircraft on the low

propulsive efficiency of its powerplant. The so-called "iron plow" is the radar, the autopilot, and the computer—and a consequence of the stream body. I have this opinion on the fact that the loads has placed on each power to the hands of the engineer that emphasis has shifted from quantity to quality. Relatively small numbers of quality engines are better than large numbers of inferior devices in range, speed, and all-weather capability. Great effort must be placed in ensuring delivery of a relatively small number of bombs, and on governing the delivery of bombs as the threat exists.

The integration of bomb radar, computer, airframe engine, and all necessary supporting equipment produces a "weapons system." Balance must be preserved among the components of the whole. Each component must probably be placed on the team, and one must find a weak link or has a difficult task to perform must never spend emphasis, special care in selection, and exhaustive proof tests before adoption.

The performance of the F-86 versus the MIG-15 in Korea proves that the Air Force has placed a well-balanced weapons system against the enemy. Although not unbalanced to fight in an unfavorable tactical situation—handling the enemy the advantages of a privileged structure, a "Korean X" was, as it were, the ratio of MIG-15 kills to F-86 losses continues to climb. The two aircraft are about equal performance with the exception of the fact that U. S. pilots do not balance by the tactical advantage and superior maneuver of the enemy. Why then the increasingly favorable ratio?

The success of one airplane depends upon many things. It depends upon the ability to handle the situation, and their manner. It depends upon the engine performance and its maintenance. It depends upon the manner of performance we have over the enemy. One success depends upon hitting the enemy with bullets and upon the damage those bullets do once they hit.

Another way of expressing this dependence is to say that the pilot must do four things. First, he has to have the means to combat. Second, he has to close to effective range. Third, he has to score his hit. Fourth, the hit has to be fatal.

Since there are several events, the probability of a successful mission is the product of the individual probabilities of successful accomplishment each step:

- $P_{TL} = P_A \times P_R \times P_{CR} \times P_L$
- P_{TL} = Probability of a kill per attempt
- P_A = Probability of mission
- P_R = Probability of closing to effective range
- P_{CR} = Probability of hitting
- P_L = Probability of kill from hit

I'm breaking this in a very general way—"leaked" can start at 100% but the chance of the relationship is that each event is dependent upon the successful accomplishment of all predecessors.

An example may serve to illustrate this interdependence. We all know that hundreds of airplanes are involved in the dog fights in Korea but only a few are shot down. One experience is about 24 MIG 15s per 1000 sightings, or one in 40. The relationship might be in follow:

$$1/40 = 1/2 \times 1/15 \times 1/2 \times 1/2$$

In other words, if 99% of the sightings turn into engagements and 20% of the engagements result in the F-86 closing to effective range, and about a 50% chance of getting into when in range—and a 50% chance that hits are fatal—the product is 1/40 or 2.5%.

Bendix Products Division

FIRST IN

FUEL METERING



Where Today's Ideas Become Tomorrow's Achievements

America's world leadership in aviation is due largely to the industry's ability to convert dreams into realities...to apply creative engineering to the solution of every new problem.

The Bendix Products Division of Bendix Aviation Corporation is proud of the part it has been able to play in meeting this challenge of constant product improvement. And Bendix

Products pledges its knowledge and resources to a continuation of this program of progress so essential to world leadership.

If the Bendix Products Division of Bendix Aviation Corporation and quality production can assist you in the development of combustion, fuel metering, starts, brakes or wheels—but let us know. Your inquiry will receive prompt attention.

BENDIX • DIVISION • SOUTH BEND

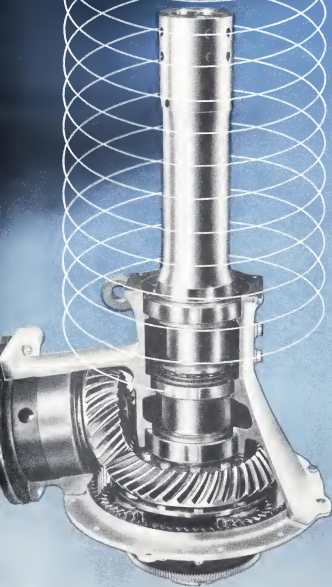
Head Office: Bendix International Division, 72 Park Ave., New York 17, N. Y.

LEADER IN

LANDING GEAR



all types of transmissions on Piasecki Helicopters manufactured by Foote Bros.



FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 SOUTH WESTERN BLVD., CHICAGO 9, ILLINOIS